Railway Engineering and Maintenance

at Is A Bar

A bargain in Rail Anti-Creepers does not mean simply low "Initial Cost", because with many of these devices there is an excessive labor cost of application which increases the "Applied Cost".

Economical "Applied Cost", while more important than low "Initial Cost", is not the final measure of economy. "Ultimate Cost" is the final measure of economy, and the proof of a "Bargain".

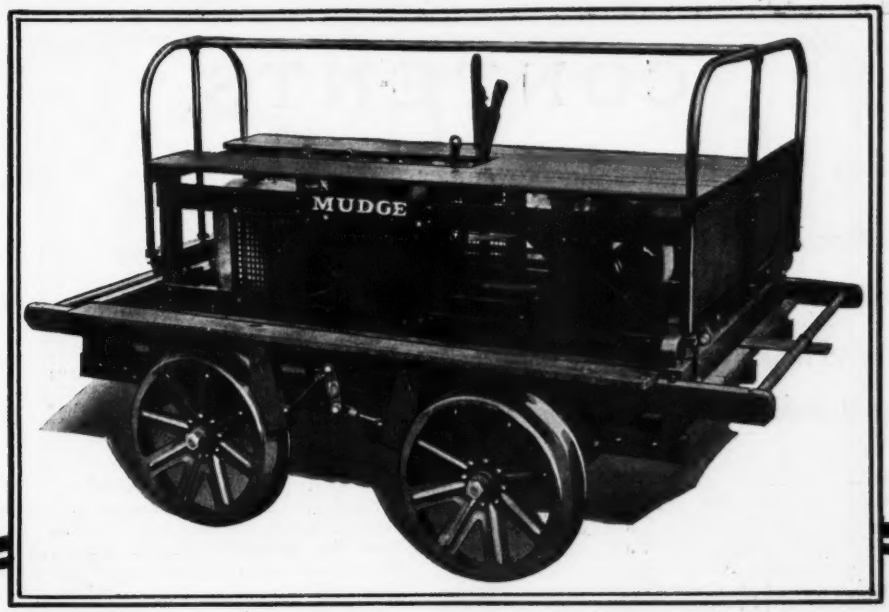
FAIR RAIL ANTI-CREEPERS are a real bargain. Their "Initial Cost" is reasonable. Their "Applied Cost" is lower than others. And their "Ultimate Cost" is incomparably low for, after out-lasting the first rail, FAIR RAIL ANTI-CREEPERS can be re-applied several times with holding power as effective as when new.

THE P. & M. CO.

CHICAGO NEW YORK
MONTREAL LONDON PARIS
CALCUTTA SYDNEY

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

Alphabetical Index to Advertisers, Page 76 Classified Index to Advertisers, 72-74



The Mudge Class WS-3 Car
for EXTRA HEAVY work

THIS heavy duty motor car has the characteristics that fit it perfectly for heavy and extra heavy maintenance work. The Class "W," 8 hp. engine, provides ample power to haul trailers carrying an extra gang of 100 men, or loads of ties, rail, bridge timbers, etc. It will pull up grades that stall most cars. The two-speed transmission permits a range in speed from 3 to 20 miles per hour.

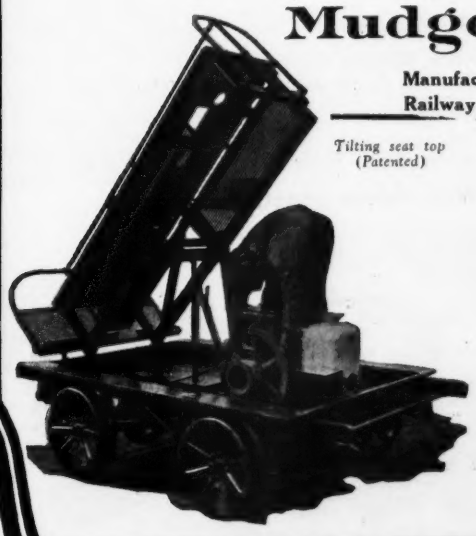
The frame and the accessories are also a step ahead of the requirements. The tilting seat top makes inspection and adjustment easy. Mudge-Bower roller bearings, both in the engine and on the axles, reduce friction losses to a minimum and provide adequate bearing for both thrust and radial loads. The thermo-syphonic water hopper, the Imperial Primer, and the "Hot Shot" battery are among the special features.

Full specifications of this car will be sent on request.

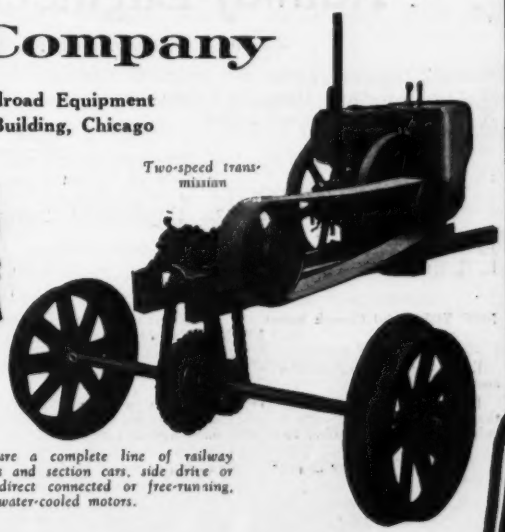
Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Building, Chicago

Tilting seat top (Patented)



Two-speed transmission



We manufacture a complete line of railway inspection cars and section cars, side drive or center load, direct connected or free-running, air-cooled or water-cooled motors.

CONTENTS

Volume 23 November, 1927 Number 11

1924

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
N. D. HOWARD, *Associate Editor*
F. C. KOCH, *Business Manager*
H. F. LANE, *Associate Editor*, (Washington, D. C.)
F. M. PATTERSON, *Associate Editor*

Published on the last Thursday preceding the date of issue by the

Simmons-Boardman Publishing Company, 105 West Adams Street, Chicago, Ill.

EDWARD A. SIMMONS, *President*
L. B. SHERMAN, *Vice-Pres.*
HENRY LEE, *Vice-Pres. & Treas.*
SAMUEL O. DUNN, *Vice-Pres.*
F. H. THOMPSON, *Vice-Pres.*
C. R. MILLS, *Vice-Pres.*
ROY V. WRIGHT, *Sec'y.*

NEW YORK: 30 Church Street **CLEVELAND: 6007 Euclid Avenue** **SAN FRANCISCO: 74 New Montgomery Street** **WASHINGTON: 17 and H Streets, N. W. MANDEVILLE, LA.**

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address please be sure to send us your old address as well as the new one.

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)

Working on the right track

Railroad men are working on the right track when they put their material handling needs up to experienced engineers. The recommendation of a bucket to fit the job often leads to big savings in maintenance work.

Above is a Hayward Clam Shell Bucket making an easy job of ash removal—saving time, making it possible to confine fire cleaning to a smaller portion of the track. It grabs big loads and empties the pit in short order.

In handling road ballast, digging ditches, coaling locomotives, reclaiming stored materials, Hayward Buckets are ready to serve men in maintenance operations.

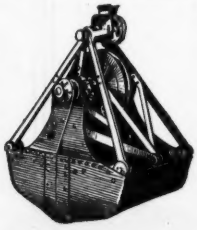
THE HAYWARD COMPANY
46 Dey Street New York, N. Y.

Builders of Clam Shell, Drag Line, Orange Peel and Electric Motor Buckets; Dredgeing, excavating, and Coal Handling Machinery, Automatic Take-Up Reels; Counterweight Drums.

HAYCO

Hayward Buckets

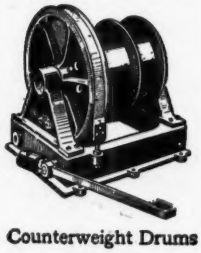
Electric Motor Buckets



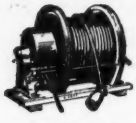
Clam Shell Buckets

Orange Peel Buckets

Drag Scraper Buckets

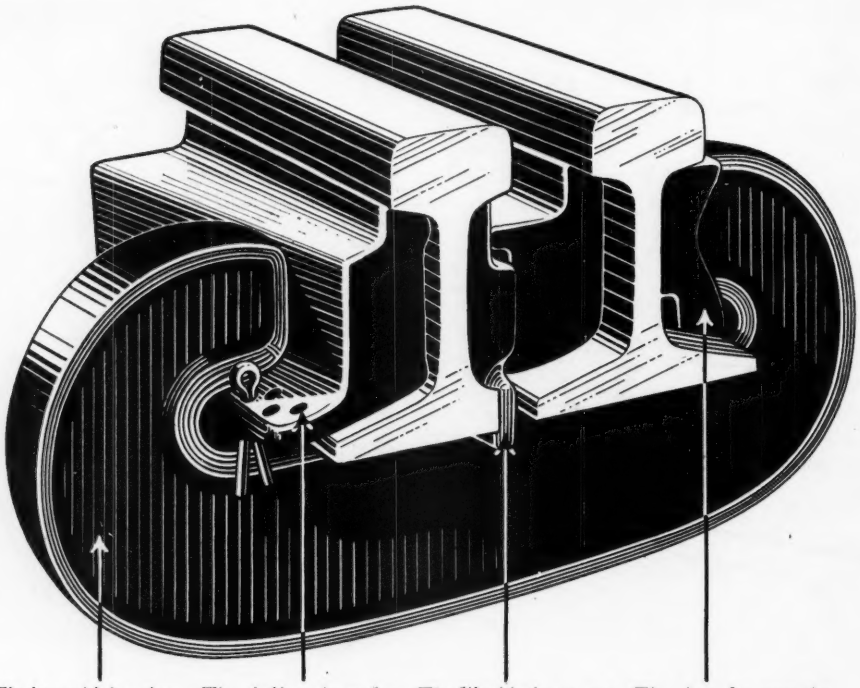


Counterweight Drums



Automatic Take-Up Reels

Skid Excavators and Dredges



The heavy high carbon, drop forged yoke is reinforced with "I" beam construction and there are no groves or keyways to weaken the section.

The shelf on the wedge has a wide bearing surface and maintains the vertical alignment of the yoke. The holes being staggered permit a fine adjustment.

The filler blocks are corrugated to allow an adjustment of 1/8" in steps of 1/8" each. The depending lugs make it impossible for the blocks to creep.

The shoe fits over the end of the yoke to prevent creepage and is made to fit the head of the rail securely.

Where Service is Hard—
and there's plenty of it

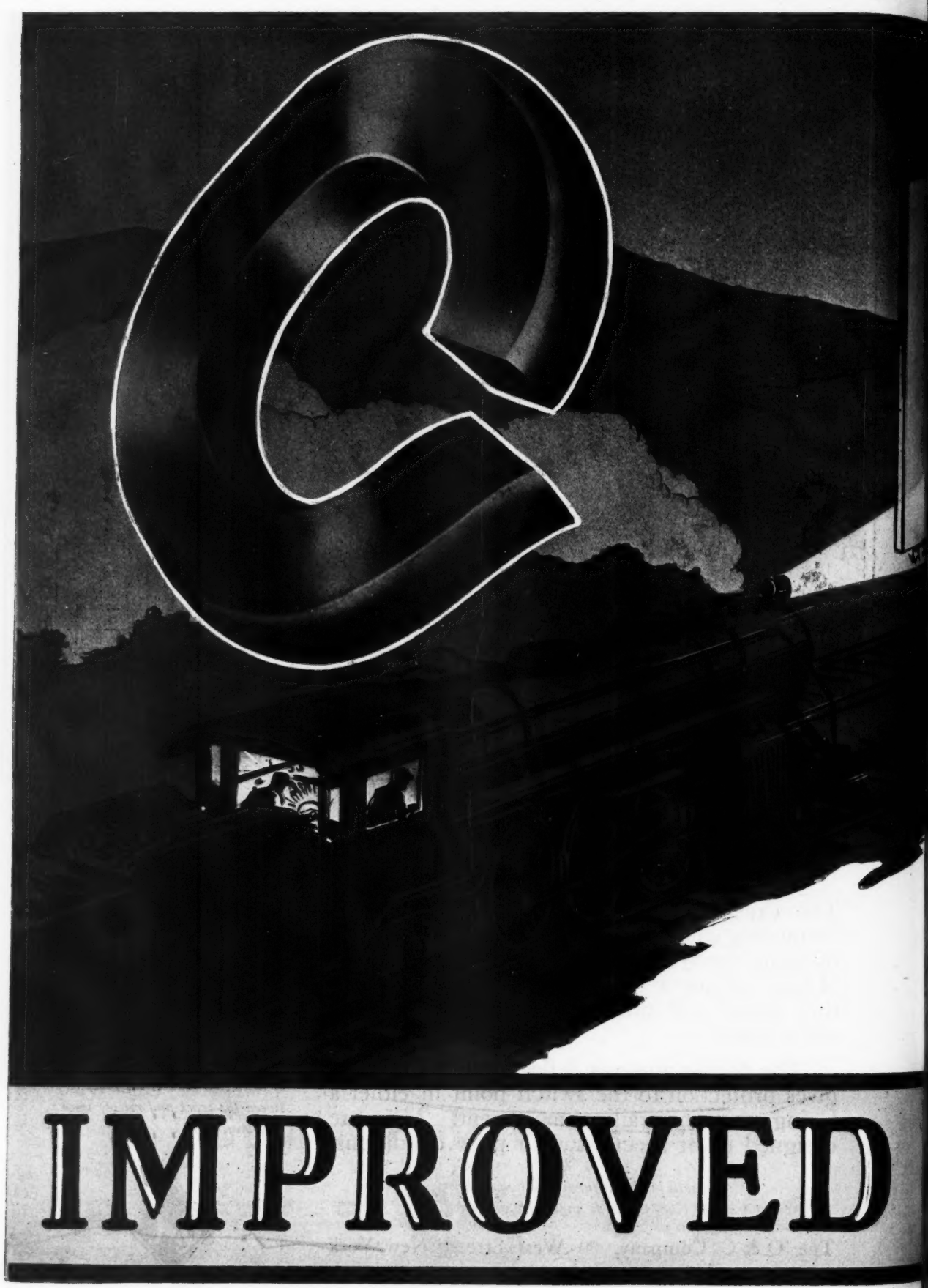
THE tremendous impacts, which the guard rail clamp of today is subjected to by the ever increasing weight and speed of equipment, is a big problem to maintenance men. To successfully meet this condition, we offer the Q & C Universal Guard Rail Clamp, which has exceptional strength and holding power under all traffic conditions. This clamp has a Universal yoke that will fit practically all rail sections by simply ordering new fittings. It is easy to apply and makes a firm installation.

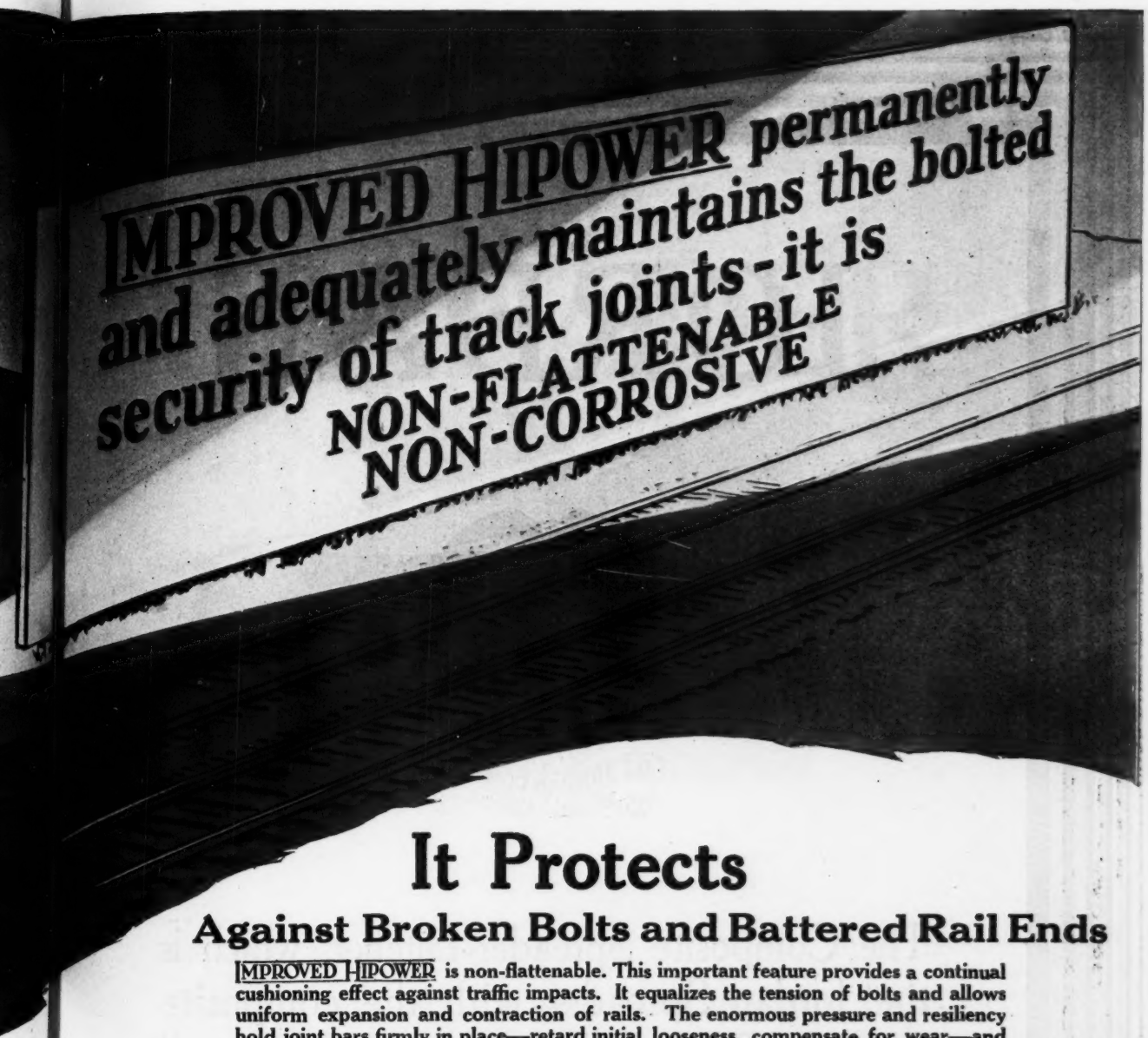
Our Engineering Department will be glad to forward you further information and blue prints on request

The Q&C COMPANY, 90 West Street, New York

CHICAGO ST. LOUIS

The Q&C Universal Guard Rail Clamp


IMPROVED



It Protects

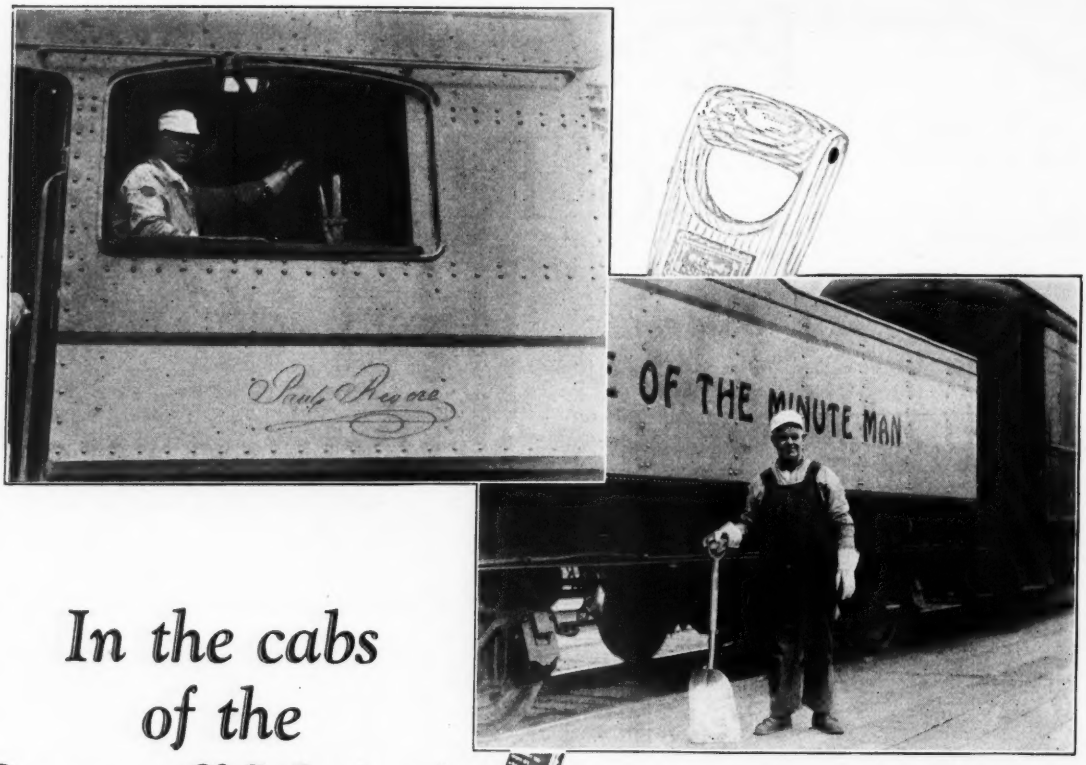
Against Broken Bolts and Battered Rail Ends

IMPROVED HIPOWER is non-flattenable. This important feature provides a continual cushioning effect against traffic impacts. It equalizes the tension of bolts and allows uniform expansion and contraction of rails. The enormous pressure and resiliency hold joint bars firmly in place—retard initial looseness, compensate for wear—and thereby prevent damage to joint structure—prolong life of rail—decrease maintenance cost and assure better track.

IMPROVED HIPOWER costs least per 1000 lb. pressure, in fact 90% less than a plain spiral spring washer.

THE NATIONAL LOCK WASHER COMPANY
Newark, N. J. U. S. A.

HIPOWER



In the cabs of the Boston & Maine's finest--

O. Ames
D-802
LOC

Fitting companions for the two crack fliers "Paul Revere" and "William Dawes, Jr." are the O. AMES Locomotive Scoops they carry.

And these O. AMES Scoops will still be delivering a real shovelful with a minimum of effort long after less durable scoops would be discarded.

For O. AMES Locomotive Scoops are built to give real service — at a price that is consistent with quality.

Write for catalog showing all sizes and types.

1242

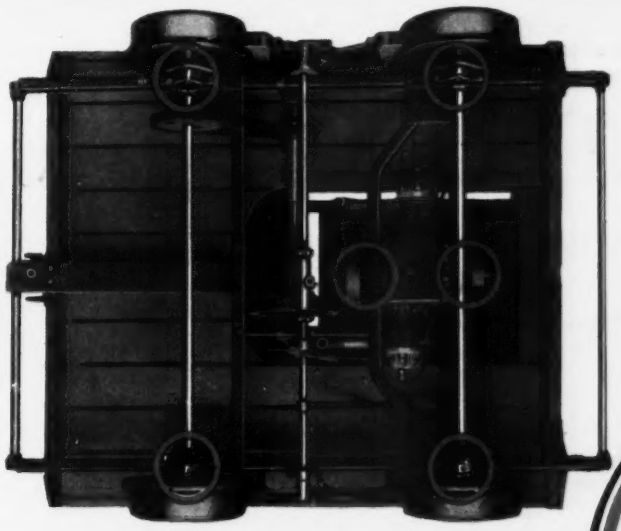
O·AMES SHOVELS

SHOVELS-SPADES-SCOOPS

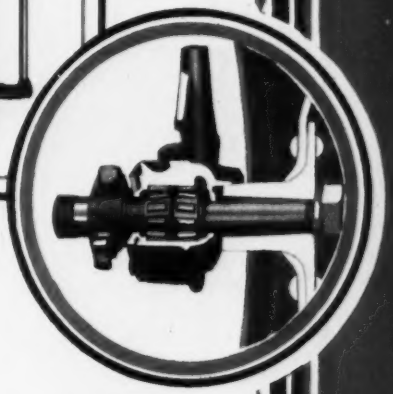
At good supply houses everywhere

AMES SHOVEL AND TOOL CO. - - - Ames Bldg., Boston
Owners of Oliver Ames & Sons Corp., North Easton, Mass. Est. 1774

Timken Bearings as applied to Sheffield 40-B Motor Car



Sectional view showing how axles of Sheffield Cars are carried on Timken Bearings. Note the sturdy bearing box especially designed to provide additional strength



TIMKEN-equipped

in line with Sheffield

PLUS *value standards*

SHEFFIELD is the first line of section motor cars to standardize on Timken Tapered Roller Bearings. The use of this advanced type of bearing marks still another step in Sheffield leadership; for in Timken-equipped Sheffield Motor Cars, Fairbanks-Morse has introduced the same type of bearing that today is used by 90 per cent of all American automobile manufacturers, and the same bearing, moreover, that is now being used on many of the finest and most modern passenger trains.

To the section motor car Timken Bearings bring important advantages. They eliminate wear on axles and crankshaft. On the Timken-equipped car there is no cutting of axles by bearing rollers. Bearing wear, negligible at the most, is confined to bearing rollers and races. Timken Tapered Roller Bearings, moreover, have a decided advantage in that both thrust and radial loads are taken care of in the bearing itself—permitting simpler, more durable construction and assuring longer life.

Not only are these improved bearings used on Sheffield Cars, but the specially designed Sheffield axle boxes, in which the bearings run, are as great an advancement as the bearings themselves. Built to lend additional strength and sturdiness, Sheffield axle boxes afford a scientific mounting for a genuinely scientific bearing. They are provided with a means of adjustment so that end play may readily be eliminated.

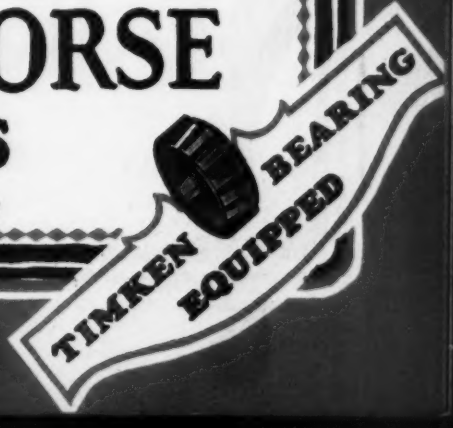
The value of Timken Bearings on section motor cars has been proved by more than two year's service on Model 40-B Sheffield Motor Cars, during which time no bearing failure has ever been reported.

Timken Tapered Roller Bearings are one of the many refinements which plainly indicate the extra measure of quality built into all Sheffield models. Timken Bearings are standard equipment not only on Sheffield Motor Cars but on all models of the new line of Sheffield Trailers and Push Cars.

FAIRBANKS-MORSE

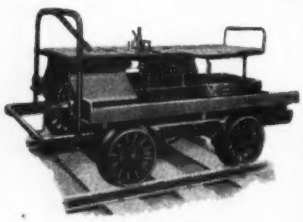
MOTOR CARS

First on the rails —and still first

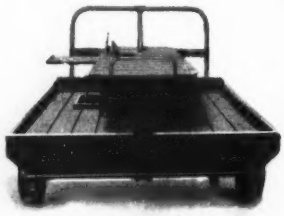


Sheffield Performance

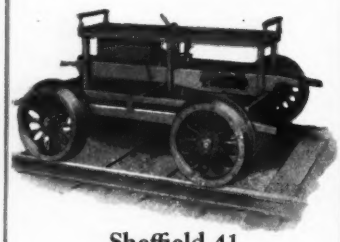
proves the value of Sheffield building



Sheffield 40-B



Sheffield 44



Sheffield 41

Fairbanks-Morse offers in Sheffield Motor Cars the finest of section motor car design and building—because Sheffield's finer construction has always proved its worth in Sheffield performance—in low maintenance and longer serviceable life—in far greater ultimate economy.

Sheffield improvements, extra quality and durability are, in fact, dividends afforded the motor car user by the most advanced motor car engineering—dividends of Fairbanks-Morse experience, resources and modern manufacturing facilities which have made it possible to embody so many refinements in motor cars so moderately priced. Where but in Sheffield cars can you equal features like those found in typical Sheffield models such as the following?

The Sheffield 40-B

Two-cylinder, four-cycle, valve-in-head, air-cooled motor, designed for exceptional torque at low speeds. Simplified friction transmission. Three-point-suspension of engine. Timken Tapered Roller Bearings on drop-forged crankshaft and axles. Auto-type pressed steel frame. Positive force-feed lubrication.

The Sheffield 44

Powerful, one-cylinder, two-cycle, water-cooled, fuel-saving motor. Positive chain drive operated by a clutch that is a real engineering achievement; clutch can be slipped freely, affords greater flexibility of control—and will not burn out! Auto-type frame construction. Timken Bearing equipped. Engine solidly mounted—no sliding base or extra belt tightening devices.

The Sheffield 41

The most popular center-load light inspection car ever put on the market. Has the easiest engine to start, due to patented priming device. Two-cylinder, two-cycle, air-cooled engine is extremely simple. Over period of ten years, the "41" has conclusively demonstrated that its operating and maintenance cost is less than half that of any other light inspection car. Extension lifting handles and Timken Bearings now regular equipment.

Write for bulletins completely describing these and other Sheffield Motor Cars, Push Cars and Trailers

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

FAIRBANKS-MORSE
MOTOR CARS

First on the rails — and still first

ARA 21.29

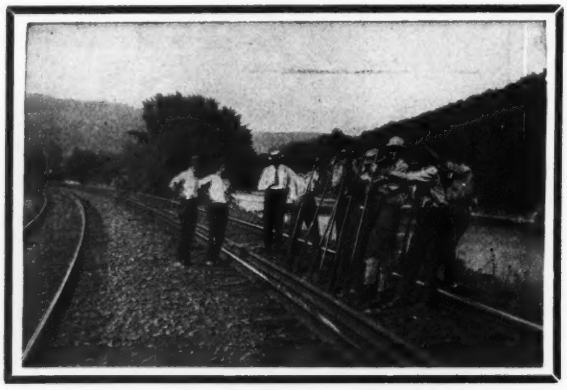
SAVING LABOR AND TOOL COSTS

THE HACKMANN Combination Track Liners can be found in use on *over 100* of the leading roads of the country, and are producing results far above expectations. For lining tracks, frogs and switches, raising low joints and spacing ties they cannot be duplicated.

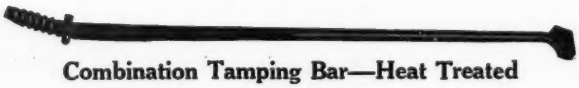
Hackmann Combination Track Liner

Try them on your tough jobs and see with what ease they will smooth rough track without disturbing the roadbed. They can be operated with unequalled success against the end of switch ties.

The Hackmann Combination Track Liners weigh but 20 pounds. They are made of steel and are small and easy to handle. Greatest efficiency is obtained when they are operated with the special bars shown below.



Combination Lining Bar—Heat Treated



Combination Tamping Bar—Heat Treated

Showing sharp curve with guard rail in stone ballast being lined by seven men with Hackmann Track Liners from 3 to 4 inches. It was impossible for 20 men to do this work with lining bars without digging.

Hackmann Duplex Track Liners are operated with ordinary lining bar. Removable Fulcrum.

Note the Two Step Feature at top of base. You can make at least two pulls without resetting the liner. They can be left in track, allowing trains to pass over without any danger.

Hackmann Duplex Track Liner

WRITE FOR ILLUSTRATED
AND DESCRIPTIVE LITERATURE

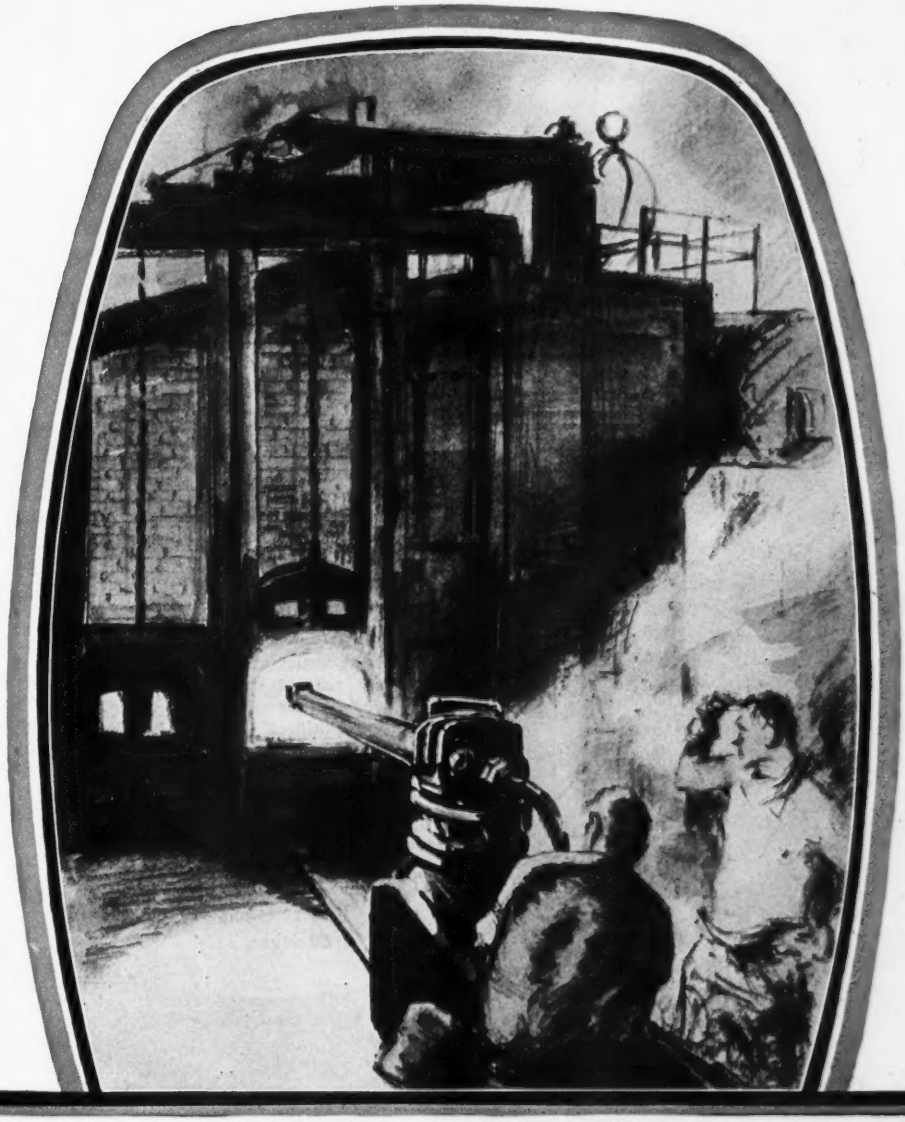
THE HACKMANN RAILWAY SUPPLY CO.

J. J. FRANZEN, *Secretary and Treasurer*

RAILWAY LABOR SAVING DEVICES—723 S. WELLS ST., CHICAGO

THOMAS D. CROWLEY CO. Representatives Chicago, Ill.
BALDWIN LOCOMOTIVE WORKS Foreign Representatives, Philadelphia, Pa.
BUFF & BUFF MFG. CO., New York
WM. ZEIGLER & Co. 425 S. Fifth St., Minneapolis, Minn.
THE HOLDEN CO., Ltd., Canada Montreal, Toronto, Winnipeg, Vancouver
ROLPH, MILLS & CO., San Francisco, Cal.

ADDRESS ALL COMMUNICATIONS TO THE COMPANY



A New Mill

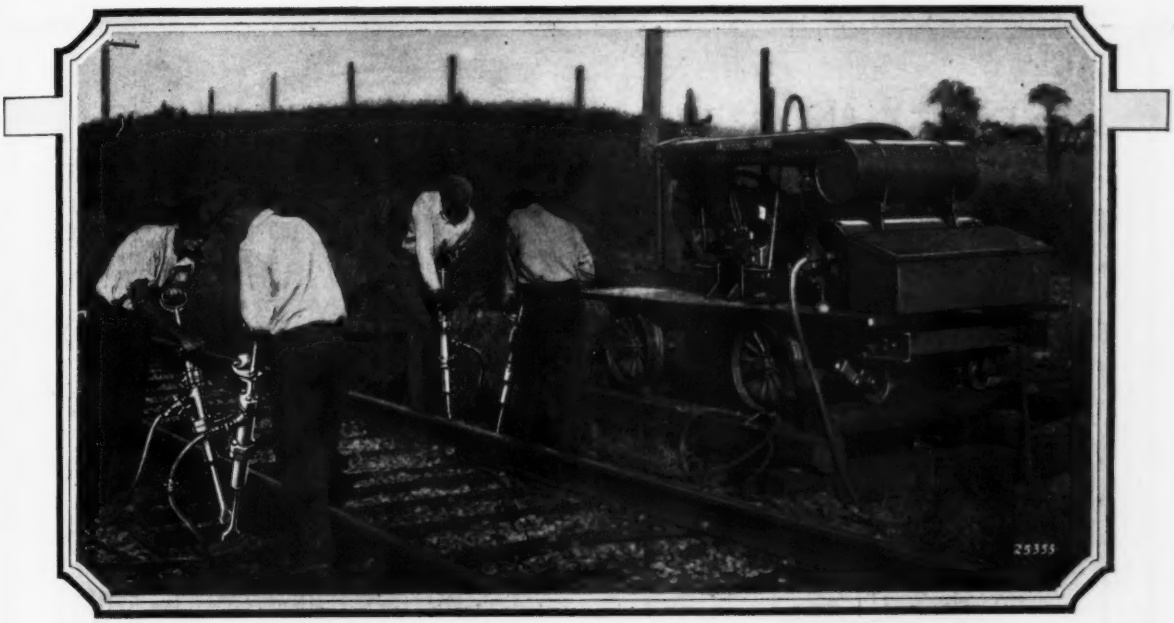
fitted with every known facility for meeting exacting specifications

To steel-making experience extending over decades, the Illinois Steel Company now adds a mill embodying the most advanced features yet devised for close-gauge rolling of alloy steel. • • Every item of equipment from furnace to pickling vat is of latest design. Every responsible position in the mill is filled by an alloy steel specialist. • • The result is alloy steel that not only meets your specifications but is of such physical quality that material savings are frequently effected in the purchaser's production costs. • • You owe it to yourself to place this dependable source of supply on your list.

Illinois Steel Company

Chicago

ILLINOIS *Alloy* STEEL



Pneumatic wrenches work ten times faster than hand methods.

Pneumatic Tamping Outfits Save Labor on Dozens of Operations

Ingersoll-Rand Tie Tamper Compressors are such convenient and handy sources of power that they are used on dozens of operations. They supply air power for a wide variety of labor-aiding pneumatic appliances.

Besides tamping ties they are used to speed up rail laying operations, bridge repair and general track construction, and maintenance work anywhere along the line.

INGERSOLL-RAND COMPANY
11 BROADWAY NEW YORK CITY

Offices in principal cities the world over
For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips, Square, Montreal, Quebec.

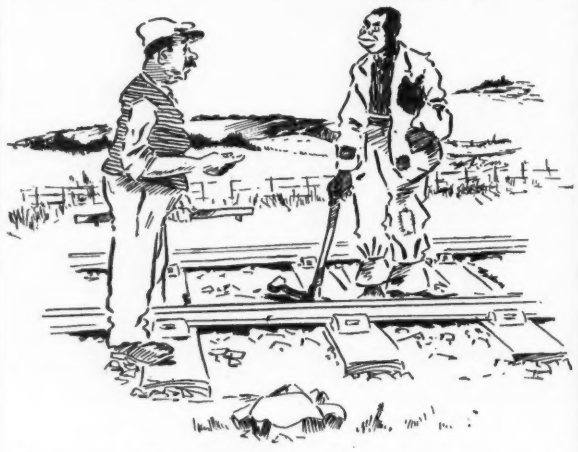
Drilling ⅞ in. bond holes in 15 seconds with Bonding Drills

Drilling ⅞ in. hole through rail in 30 seconds with No. 9 Rail Drill

Driving spikes in 6 seconds with CC Spike Drivers.

Ingersoll-Rand

SPEEDING UP THE TAMPING



Foreman: Have you noticed that Sam tamps two ties to your one?

Rastus: Yes, Ah have, but 'tain't mah fault. Ah done spoke to him about it.

—Adapted from the South African Railways Magazine.

There is no more need for such performances as given by Rastus any longer.

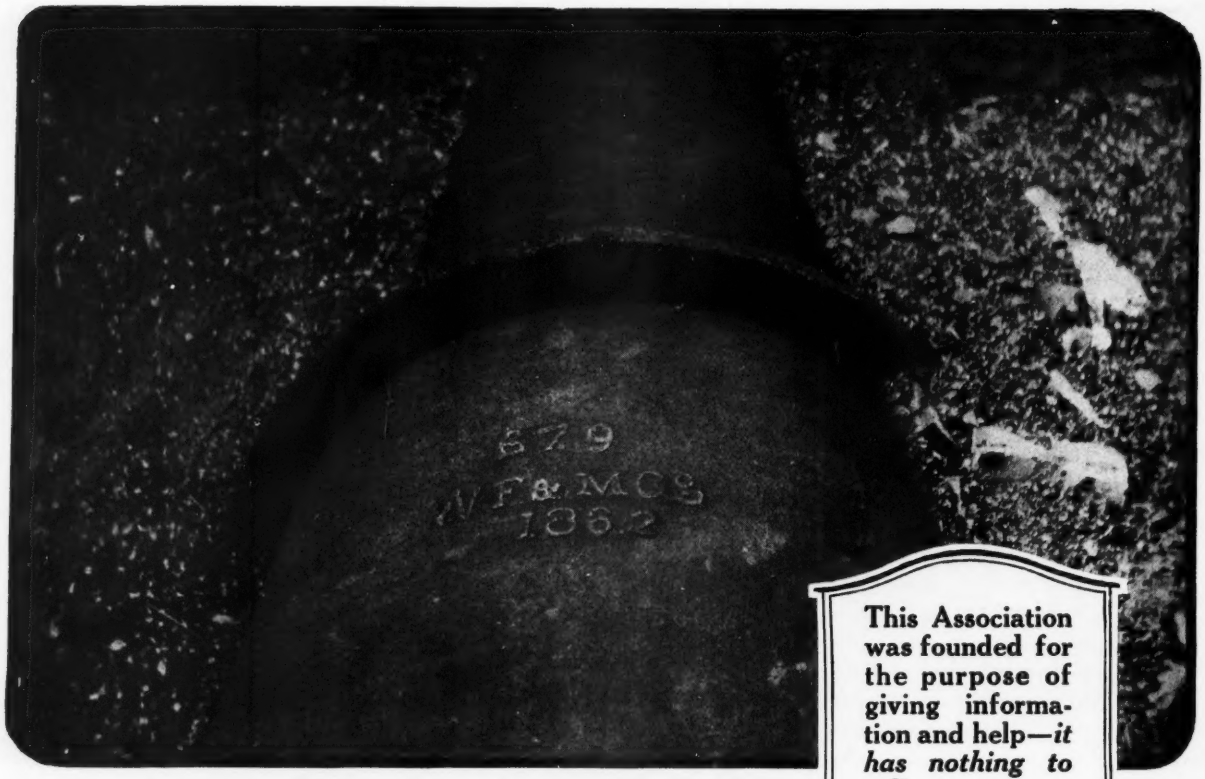
Jackson Electric Tie Tampers are replacing this sort of work and with men like Sam handling the tamping units, records are proving the value of using an electrical mechanical device for tamping ties.

Besides making greater progress, roads using Jackson Electric Tie Tampers find that they procure a more evenly and firmly tamped roadbed.

Equip one of your gangs with an outfit and be convinced that your tamping problems can be met in a most satisfactory manner.

ELECTRIC TAMPER & EQUIPMENT CO.

CHICAGO ILLINOIS



"679 WF&M Co. 1862"

(Warren Foundry & Machine Company)

Such inscriptions, brought to light from time to time, are constant reminders of the permanence and low maintenance cost of Cast Iron Pipe

IN fact there is no case where Cast Iron Pipe has worn out under the usual service conditions.

It is a standard of practice where Cast Iron mains have to be replaced with larger diameter pipe to relay the old pipe elsewhere.

There is therefore no data available to determine the ultimate working life of Cast Iron Pipe. One of the earliest installations on record is one that was laid in Europe 250 years ago. This pipe is in as good condition today as it was when installed.

CAST IRON PIPE RESEARCH ASSOCIATION
People's Gas Building, Chicago, Ill.

This Association was founded for the purpose of giving information and help—*it has nothing to sell.*

Its primary interest is the collection and distribution of all information relative to Cast Iron Pipe for all purposes—and in arousing public interest in waterworks construction.

Consulting engineers, contractors and municipal officials are invited to write.

Of especial importance is an article on the "two mains system." Write to the Research Engineer for a copy of this or other literature on the subject of water systems which may be interesting to you.

BELL *and* SPIGOT JOINT—*the accepted standard for underground construction.*

CAST IRON PIPE

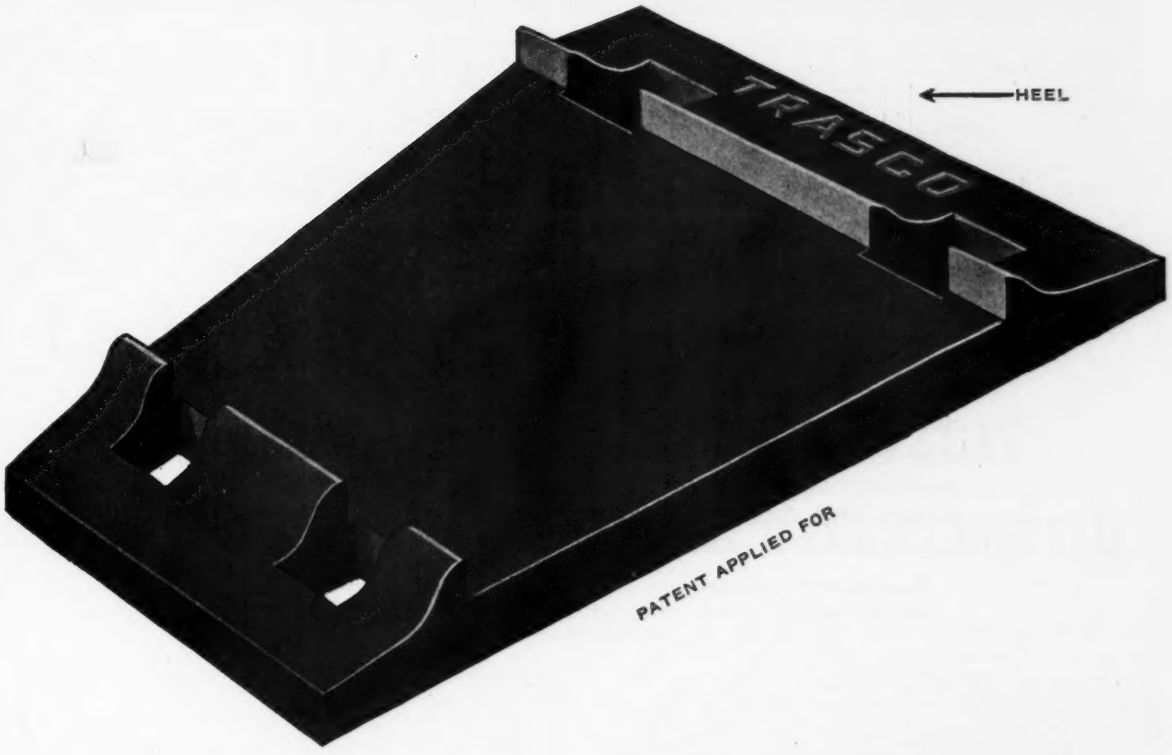
—In continuous service for over 250 years

TRASCO

TRADE MARK REGISTERED

TRAPEZOIDAL TIE PLATE

Always On The Level

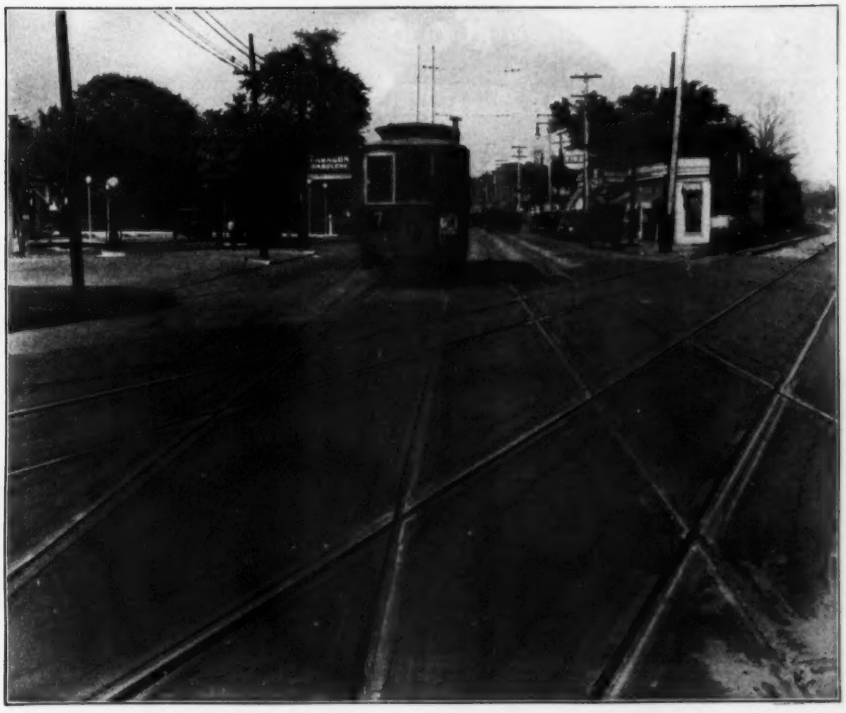


This plate doesn't take a heel dive into the tie
It saves 10 to 25% in your first cost
It prolongs the life of your ties—rails and wheels
Write us for data and prices

TRACK SPECIALTIES CO.

29 BROADWAY
NEW YORK

Cable Address: "TRASPECIAL"



Pennsylvania R. R. Crossing, Norwood, Ohio. This smooth crossing is a splendid example of how Carey Elastite Preformed Track Pavement can be fitted to this type of construction. Note the irregular-shaped sectors between the rails and the snug fit of the preformed slabs.

Learn more about the remarkable pavement that protects this modern crossing

THIS smooth, traffic-proof crossing is six months old. And, through many times six months of low-maintenance service, it will continue to improve. For, Carey Elastite Preformed Track Pavement knits and heals under the constant hammering of a steady stream of traffic.

As can be seen in the photograph, the construction problems were complicated. Yet the work was done rapidly, with ordinary tools and ordinary labor. Be sure to get full information about this remarkable crossing pavement. A letter will bring you the facts.

Carey Elastite Preformed Track Pavement consists of slabs about two inches thick and sections of rail filler, both made of a fibrous, asphaltic material that knits and heals under traffic. The preformed slabs, set snugly in place, form a traffic-proof crossing that will last indefinitely.

THE PHILIP CAREY COMPANY

Lockland, Cincinnati, Ohio

Carey Elastite

PREFORMED
TRACK PAVEMENT

"How Good?"
is much more important than "How Much?"

WHEN you place your order for ties—don't buy ties that are produced just to meet a certain price—but invest in ties that are manufactured to meet the A.R.E.A. Specifications. Remember too—that because ties are marked 5's that does not make them 5's. Put the rule on them—see if they measure 7 x 9 inches, minimum. Investigate also whether the ties are seasoned on the right-of-way on weedy wet soil;—or on specially built seasoning yards.

All *International* Ties are produced in strict accordance with the A.R.E.A. Specifications. That assures sound timber, proper grading, careful seasoning and scientific treatment with the best creosote oil.

They give a far lower cost per year and your small extra investment will be returned over and over again in longer life, fewer renewals, lower maintenance and added years of dependable service.

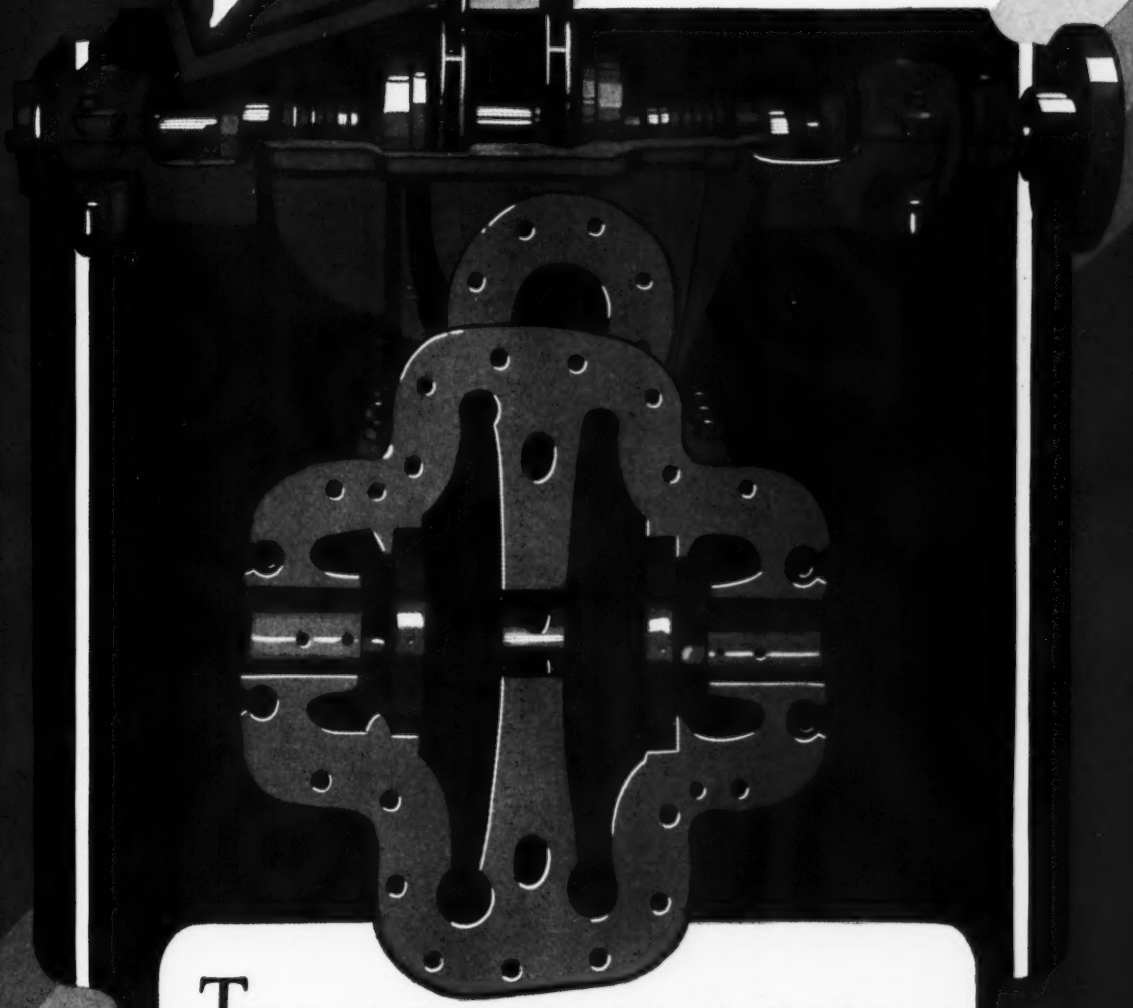
International Creosoting & Construction Co.
General Office—Galveston, Texas

International
STANDARD SPECIFICATION TIES

– See –
Railway Engineering and Maintenance 1926 Cyclopedia Edition for detailed information

AMERICAN
AURORA, ILL.

"See our exhibit at the Sixth National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, December 5 to 10, 1927."



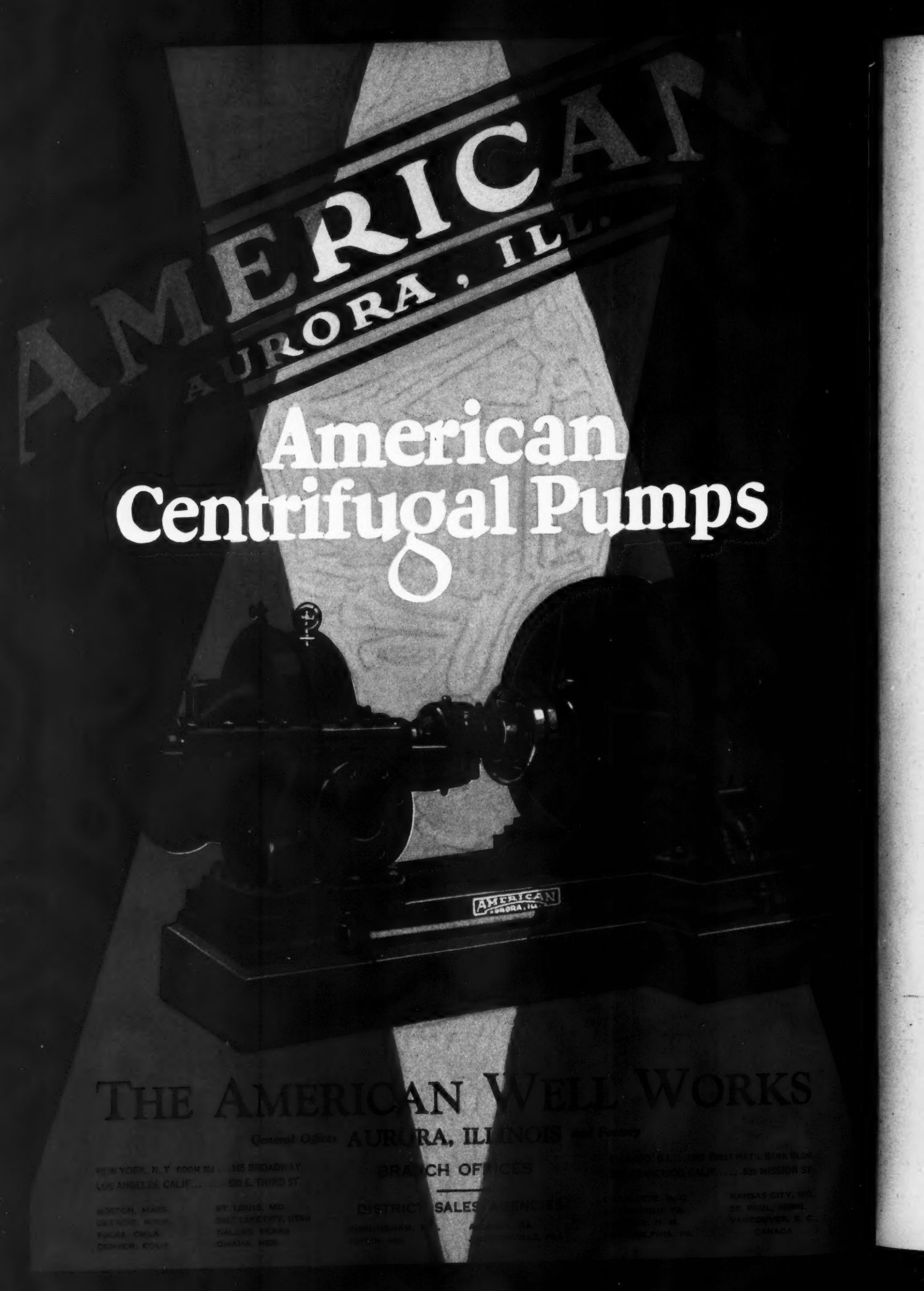
THE "American" S. I. pump is a horizontal, split shell, 2-stage pump, furnished with bronze enclosed impellers, labyrinth bronze wearing rings, bronze shaft sleeves, and bronze split glands. The pump has ring oiling bearings with a ball thrust on the outboard bearing to take care of any unbalanced thrust which may occur.

This pump is designed with opposed impellers, which take care of end thrust. The impellers are single suction type, and are hand filed and properly designed to give the highest efficiency possible. The pump is provided with a flexible coupling of the pin and bushing type to connect to prime mover.

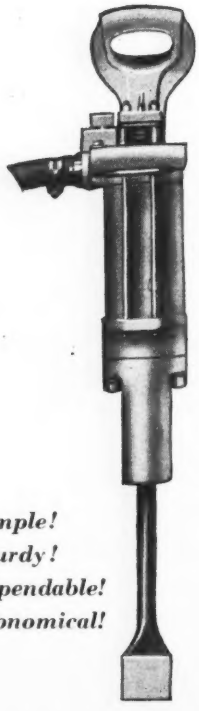
The bearings of the pump are entirely separate from the stuffing boxes which eliminates the possibility of grit in the bearings. However, the reservoirs are large, furnishing a liberal supply of oil. The stuffing boxes are water sealed, so as to insure tight packing without excessive pressure or friction on the revolving shaft.

This pump is furnished in sizes from 1¼" to 10", capacities up to 4000 g.p.m., and total heads of 500′ on larger sizes and capacities.

Write for catalogue to the nearest office.


AMERICAN
AURORA, ILL.
American
Centrifugal Pumps
AMERICAN
AURORA, ILL.
THE AMERICAN WELL WORKS
General Offices AURORA, ILLINOIS
NEW YORK, N. Y. ROOM 511 . . 115 BROADWAY
LOS ANGELES, CALIF. . . . . 520 E. THIRD ST.
BOSTON, MASS.
DETROIT, MICH.
TULSA, OKLA.
DENVER, COLO.
ST. LOUIS, MO.
SALT LAKE CITY, UTAH
DALLAS, TEXAS
OMAHA, NEB.
BRANCH OFFICES
DISTRICT SALES AGENCIES
KANSAS CITY, MO.
ST. PAUL, MINN.
VANCOUVER, B. C.
CANADA

There are Thirteen men in this Picture!



Simple!
Sturdy!
Dependable!
Economical!

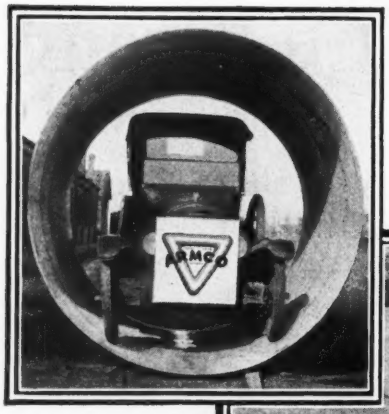
THE eye only sees five. The Syntron tie tampers this road gang is using make up the other eight. In other words 4 Syntron Tampers take the place of a gang of twelve men working with picks and shovels. And they work steadily throughout the day without faltering or losing a single stroke. The Syntron Tamper is simplicity itself, having but one moving part. It is operated by electricity supplied by a light weight gasoline power plant. This plant runs 4 tampers and is very easily moved from place to place. Operating costs are extremely low.

What Syntron is now doing for some of the largest roads in the country in the way of reducing maintenance costs, it can do for you. And we'll be glad to show you.

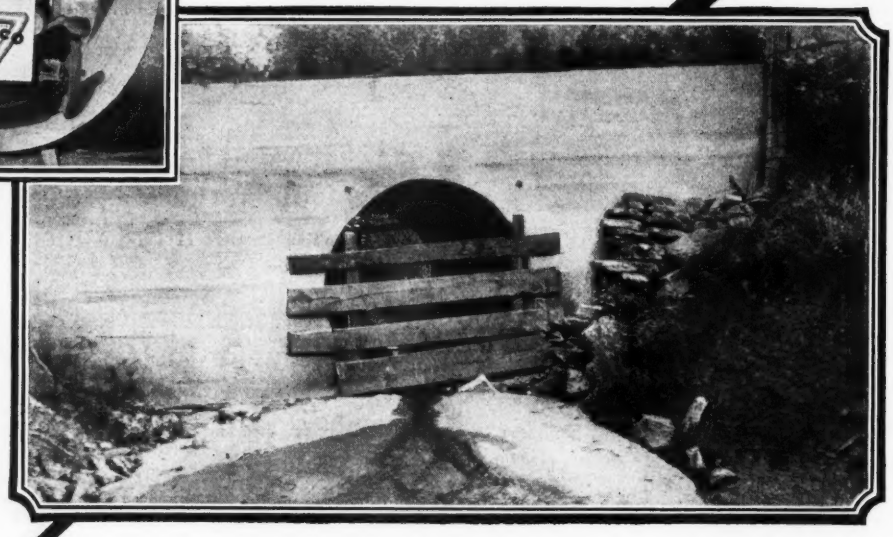
SYNTRON COMPANY
400 Lexington Avenue PITTSBURGH, PENNA.

SYNTRON

Tie Tampers



SAFE



This Ford shows the roomy size of under-crossing provided by a 9-ft. Armco pipe.

Use a large sized ARMCO *for safe under-crossings-*

IT is often desirable to provide permanent openings under roadways for other than drainage purposes, such as cattle passes, pedestrian subways, or conduits for gas pipes, electric lines and sewers.

Engineers have found Armco Corrugated pipe combines low cost with unusual durability—and safety—in service. The same advantages are gained in this use that have made Armco Culverts predominant in use—immediate availability, quick installation, strength to withstand weight of fill, load of traffic or strains from settling foundations and shifting soils.

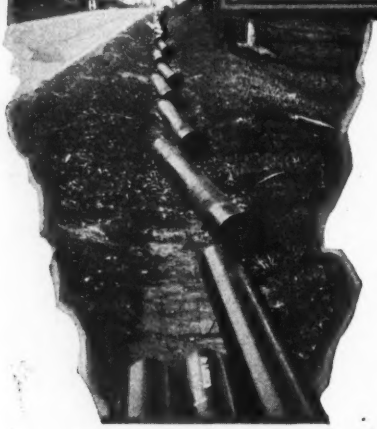
When the need for the under-crossing arises after the roadway is built, the pipe can be installed by the new jacking method *without interrupting traffic.* Our engineers will be glad to give details. A request brings the information.

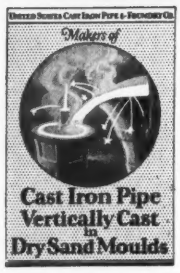
ARMCO CULVERT MANUFACTURERS' ASSOCIATION
Middletown, Ohio

ARMCO CULVERTS

Predominant in use—because predominant in quality

deLavaud centrifugal pipe at Orchard Park, New York





deLavaud Centrifugal Cast Iron Pipe *costs less to lay*

CONTRACTORS have learned by experience the decided saving in handling and laying deLavaud centrifugal pipe.

Its lighter weight and self-centering bell make the actual handling much easier.

Experienced contractors are therefore able to make lower bids, which in some installations average 8% below other pipe.

Engineers and contractors are invited to write for further details. They will be of great assistance in figuring on bids for installations.

United States Cast Iron Pipe and Foundry Company

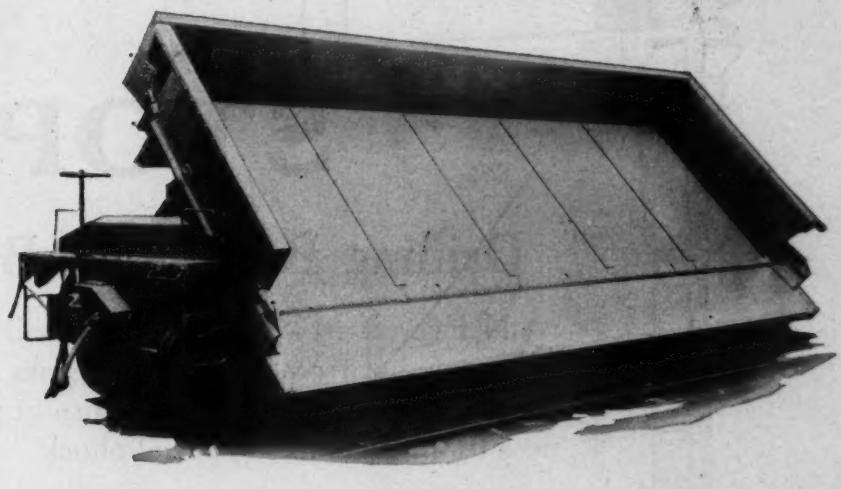
General Offices:
Burlington, New Jersey

SALES OFFICES

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
Buffalo: 957 East Ferry Street
Cleveland: 1150 East 26th Street
New York: 71 Broadway
San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
Minneapolis: 6th St. & Hennepin Ave.

A New Dump Car from the Shops of the Pioneer Builder

New Western Drop Door Dump Car



THIS new Western Drop Door Car for railway maintenance-of-way is of low loading height with dual side pivots and single stroke cylinders.

It permits a railroad ditcher to dig deeper and the drop door gives complete protection to the ballast. The drop door extends 4 feet 8 inches out from the rail.

The steep discharge angle of 50 degrees and a kicking mechanism give the load added momentum at the time of discharge, leaving the bed of the car clean.

The drop door keeps the dumped material clear of the track and decreases the frequency of spreading and permits wider shoulders.

Built to ARA and ICC specifications and adapted to revenue service.

Bulletin 27QRE explains this new Western automatic drop door air dump car in detail.

Write for your copy today.

Western

Better Buy Westerns NOW Than Buy and Buy

Western Wheeled Scraper Company

Pioneer Builders of Dump Cars

Aurora, Illinois, U. S. A.

Railway Engineering and Maintenance

Volume 23 November, 1927 Number 11

THE END OF AN ACTIVE SEASON

ANOTHER "working season" for maintenance of way forces is now drawing to a close. It has been an active season, surpassing all others in the volume of work done. Measured in expenditures, the total amount spent by the roads of the United States for the first eight months of 1927 was $585,045,760, or $8,975,380 more than in the same period last year. The real significance of this activity is shown better by a comparison with similar figures for the years since the depression of 1921, as follows:

1921	$507,837,688
1922	480,863,544
1923	533,129,038
1924	528,945,633
1925	540,863,711
1926	576,070,380
1927	585,045,760

The full measure of the work done this year is not shown, however, by the comparison of expenditures. The season now closing has been unusually favorable for maintenance work. With the exception of the floods in the lower Mississippi valley, there have been no unusual disasters to disorganize programs while on the contrary, particularly in the latter part of the season, the weather has been particularly favorable for field work. The supply of labor has also been better than usual, both in quality and in quantity and the turnover has been less than normal. As a result, the amount of work completed compares even more favorably with that in preceding years than the expenditures would indicate, and the steady improvement in the condition of the roadway and structures which has been in progress during the last three or four years has been continued if not accelerated during this year.

TIES 100 PER CENT TREATED AND PLATED

THERE WAS a time when any railroad was deemed progressive in its attitude toward timber preservation if 50 per cent of its tie renewals was made with treated ties and if it used tie plates on all curves. At that time the use of treated timber and tie plates were considered refinements that were deemed hardly applicable to yards or branch lines. That there has been a marked advance in practice with respect to the conservation of ties is indicated by the fact that in a large yard now under construction on one railroad the tracks are being laid entirely with creosoted ties and are 100 per cent tie-plated while another road is building 200 miles of branch lines on which the same rule applies.

The question has often been raised why a railroad which finds it economical to treat part of the ties it uses for renewals, should not find it economical to treat them all. Various answers have been offered, of which probably the most valid is that any railroad which had been inserting untreated ties and which should suddenly decide to treat all of its ties would be confronted with a sharp increase in maintenance of way expenditures that would serve to upset the relation between earnings and operating expenses. This, of course, is one of the arguments which has been advanced in efforts to prevail upon the Interstate Commerce Commission to change its rule with respect to the replacement of an untreated tie by a treated tie, whereby the entire cost is charged to operating expenses, regardless of the fact that the treated tie represents an increase in investment over that of the untreated tie. However, this very rule points to the advantage of building new tracks entirely with treated ties since in no other way is it possible to insure that the full cost of an installation of treated ties in a new track can be charged to capital account. But regardless of the difficulties which have been imposed with the advent of the treated tie, we are confronted with constantly recurring demonstrations of the fact that railroad managements have become thoroughly convinced of the economy of using treated timber and that the time is not far off when virtually all wood used in tracks will be subjected to preservative treatment before application.

THE NEW ATTITUDE TOWARD MATERIALS

ONE OF the marked changes that is taking place in railway service today is in the attitude of maintenance of way and stores department officers toward each other. On not a few roads there has been a wide chasm between the two, each suspicious of the other and guarding its prerogatives against the other. Of late, however, there has been a growing realization of the fact that each department benefits by co-operating with the other and on not a few roads this change in attitude has reflected to the decided benefit of the common employer of both departments—the railway company.

This change in attitude is reflected by the action of the Roadmasters Association in inviting a leading exponent of material control, H. C. Pearce, director of purchases and stores of the Chesapeage & Ohio to address its recent convention. It is reflected likewise by the similar action of the Bridge and Building Association in asking another prominent advocate of stock supervision to speak before its convention at Minneapolis two weeks ago. Both of these men rendered valuable service to the railways as a whole by pointing out the possibilities for improvement in the handling of the materials used by these important groups.

The marked reductions in stocks of materials that have been effected in some quarters are not solely the result of the efficiency of the stores departments on

these roads and the maximum benefits are not possible by their effort alone. Rather, as was pointed out by Mr. Hall in his address which will be abstracted in a later issue, the largest economies are possible only when co-operation of the using department is secured.

Maintenance forces require many materials in the conduct of their work. They must have them in the form and the quantity required *when* they need them. It is the duty of the stores department to meet these needs. Any provision beyond actual requirements or unduly in advance of them is, however, a waste from which no one benefits. Such surplus was almost universal a few years ago. It still prevails on many roads today. It can be eliminated without adverse effects only through the co-operation of the two departments in determining the minimum reasonable requirements.

The modern conception of the control of maintenance of way stocks is no longer that of a battle of wits, but rather a union of wits. Adopting this broader viewpoint the maintenance of way department has the same responsibility as the stores department in eliminating excess stocks for, as pointed out by Mr. Hall, it costs heavily to carry such stocks. The extent to which the maximum benefits are to be realized in this direction depends in no small measure upon the manner in which the officers of these two departments approach this problem and the tact they use in its solution.

BE SURE TO CONSIDER ALL THE FACTS

NOTHING is more sure to retard advancement in the application of labor saving equipment than loose talk. This applies both to extravagant claims by manufacturers' representatives and to inaccurate reports by railroad men with respect to the performance and advantages of particular units of equipment. It applies with equal force to criticisms of mechanical equipment founded on incomplete knowledge of its nature, the character of the work it performs and the limitations imposed in its application.

To illustrate this statement, the case may be cited of a certain type of machinery which was reported as having demonstrated marked economy on one railroad, whereas experimental use on another road indicated that it was not a success. The reason for these contradictory reports was not clear until attention was directed to the fact that this particular machine is too heavy to be taken off the track to clear for trains and that in the one case it had been used on a double-track line where arrangements had been made to take one track out of service and that on the other road it was used on a single track line where an excessive amount of time was occupied in running to sidings.

A somewhat parallel case to which attention may be drawn is the statement of a railway officer who, in comparing two types of equipment designed for the same general purpose, expressed the opinion that the introduction of a more elaborate and heavy machine would result in its superseding a more simple and lighter piece of equipment. Here again, investigation shows that one piece of equipment is of advantage under a certain set of conditions, whereas the other, while perhaps not as efficient, can be employed under conditions which would not permit the use of the first machine at all.

A certain roadmaster criticised a particular device as being too complicated, supporting his criticism by the statement that he was compelled to employ men of such low intelligence that they could not be expected to master the intricacies of any such machine. On the other hand, a maintenance officer in the southwest reports marked success in the operation of mechanical appliances by Mexicans after only a few days training in the use of machinery with which they had had no previous knowledge.

These illustrations should serve to indicate the harm that will be done through the making of ill-advised statements. Every maintenance of way man ought to have a whole-hearted interest in the increased use of labor saving equipment whenever this will result in economy in the performance of his work. He should, therefore, be willing to consider carefully every opportunity for securing economies through the introduction of a new piece of equipment.

HELP THE FOREMEN TO UNDERSTAND IT

CONCRETE is, comparatively speaking, a new material of construction and in the absence of knowledge gained through centuries of use, it has been necessary to search for facts concerning the variations in its physical properties with differing aggregates, proportions and methods of mixing, through the agency of experimentation. Obviously, such investigations must be conducted under scientific control and it naturally follows that the results of these studies will be recorded in the language of the scientist. This was the case with the first literature distributed with respect to the water-cement ratio, which is now generally conceded to be among the most important discoveries ever made in the field of concrete. The method of its application involved the use of tables, charts and mathematical formulae so involved as to be entirely unintelligible to the very men who must understand it, if it is to be applied in the average run of concrete work, namely the foremen.

This has resulted in efforts at the simplification of rules for proportioning concrete in accordance with the law of the water-cement ratio, of which the most outstanding example is the presentation incorporated in the report on recent developments in concrete, relating to the proportioning of concrete, presented at the recent convention of the Bridge and Building Association, which report was written by a railway man in daily contact with field forces and familiar with their limitations. As a result this report was characterized on the floor of the convention as the clearest description of the manner of applying the water-cement ratio that has yet appeared.

Some roads have applied the new principle, at least in part, by making careful tests of the various aggregates commonly used on their lines for the purpose of ascertaining what proportions of sand and stone will give the most workable mix for a given water-cement ratio and then furnishing the foremen with tables of the proportions of cement, water, sand and stone for each class of concrete. This is the practical plan for obtaining the benefits of this scientific principle. However, it must be borne in mind that the aggregates from almost any given source are subject to variation as to grading, water content, etc., which necessarily results in some variations in the consistency of the concrete mixed to fixed proportions. Consequently, some variation in the mix *must* be made by the foreman on the job from day to day, even from hour to hour, if the desired strength of the concrete is to be obtained, for the law of the water cement ratio applies only when the mix is a *workable one*.

Therefore, in issuing tables of proportions, such as are outlined above, the foremen must be made to understand that if the concrete is too sloppy or too dry or "harsh" and in his judgment is in need of some change in the proportions in order to obtain proper consistency, he may do so by increasing or decreasing the

amount of sand or stone per sack of cement, but that *under no circumstances* is he to change the amount of water.

Foremen, in fact all men concerned with concrete, have so long believed that the strength of concrete depends primarily on the proportion of cement to sand and stone that it is difficult to overcome this idea. But as soon as they come to understand that the number of gallons of water per sack of cement is the real criterion, the application of the water cement ratio will become a simple matter.

THE FIRST STEP IN REDUCING COSTS

THE engineering and maintenance of way department of a railway is a spending organization. Every operation it undertakes costs money, while none in itself produces any revenue. Its function is to spend money—to spend it as efficiently as possible. To do this requires a knowledge of costs.

This requirement is not peculiar to the railways. It is found in all successful industries. As a result more or less complete systems have been developed in many industries for the determination of the costs of their various operations to enable those in charge to determine the relative merits of different methods and to select those which are shown to be the most economical.

In spite of the multiplicity of operations and the frequency of their repetition, relatively little attention has yet been given to the determination of unit costs in railway service, in the modern interpretation of that term. This is particularly true of maintenance of way operations. It is true that the auditing department compiles certain data, but they are prepared for purposes of record rather than for the analysis of methods. Furthermore, they are available only after a considerable interval, commonly after the task is completed and the forces disbanded or transferred to other operations. They also possess the fundamental defect of having been compiled by persons who are unfamiliar with the work or the conditions under which it was performed. In discussing cost data on a railroad, therefore, it is important to differentiate between the information compiled by the accounting department and that designed to afford a prompt knowledge of unit costs—a distinction that the discussion at the recent convention of the Roadmasters' Association indicated is not made by many maintenance of way officers.

While the development of a system of cost accounting for maintenance of way work is as yet in its infancy, some progress has been made. The outstanding development is the system that has been put into effect by the Chesapeake & Ohio, as described on pages 458 to 465 of this issue. While this resembles in many respects the method that was in effect on the Baltimore & Ohio for a number of years prior to the war, it possesses the advantage of greater simplicity in a number of respects. That it is entirely workable is shown by the experience of the C. & O. during the two years that it has been in operation. The remaining question is whether it is worth while.

To demonstrate the merit of a cost analysis plan to the management of a road on which it is not in effect is a difficult task because of the fact that the installation of such a system means an additional out-of-pocket investment, whereas the amount of money that will be saved is difficult of determination because of the fact that such a road is unable to estimate the amount of money it is losing by reason of inefficient methods among all or a part of its forces. Unit costs provide a basis for the determination of this loss; if they are decreasing the conclusion may properly be drawn that the efficiency of the force is increasing, whereas if the opposite trend appears supervisory officers can detect it promptly and set about to eliminate the cause.

The best evidence of the value of such a system is that afforded by the experience of the C. & O. which with an outlay of $36,504.38 for expenses of administration of this system in 1926, effected a saving of $87,745.30 by reason of more efficient methods, a net economy of $51,240. Furthermore, with the extension of this system over a larger mileage of this road last January, it is expected that the net saving in maintenance labor expenditures that will be effected this year by reason of more efficient operation will be $195,000. Such figures are impressive and deserve careful study by maintenance of way men generally. Greater refinements are demanded and are being introduced in all branches of railway service today. The determination of costs is such a refinement.

AN INVESTMENT IN NEATNESS

"ORDERLINESS and cleanliness are of first importance. It may be possible to secure satisfactory results with dirty and ill-kept plants, but the probability is in the other direction." These statements are taken from a report presented by the Committee on the Maintenance and Operation of Water Treating Plants at the recent convention of the Bridge and Building Association, abstracted on page 480. While referring specifically to treating plants, these comments apply with equal pertinence to other branches of maintenance work.

It is not long since the large majority of railway officers gave little or no thought to appearances, demanding only that the facilities be prepared at all times to render the service for which they were designed. In fact, there are not a few men today who regard energy spent in cleaning up about railway property as wasted and as an unnecessary refinement from which no return is secured. That this attitude is passing rapidly is shown by comments such as that quoted above which typify the growing realization on the part of an increasing proportion of railway officers of the direct relation between neatness in the care of railway facilities and the efficiency with which those facilities are maintained and operated.

The committee places the responsibility for the condition with which railway facilities are maintained directly upon supervisory officers, stating that "the appearance and general condition of the plant are indicative in a general way of the ability of the operator *and of the supervisory officers.*" This comment is particularly deserving of emphasis for it is a common observation that the attitude of the supervisory officer is reflected in the actions of his foremen and they will, as a rule, be no more careful in the performance of their duties than he requires them to be.

Entirely aside from the beneficial effect which the appearance of a property has on the general public, industry as a whole is rapidly discovering that there is a direct relation between neatness in the performance of work and the accuracy and efficiency with which it is done. Railway service is constantly making more exacting demands upon its facilities and the increasing density of traffic is making delays from "unexpected" breakdowns or failures more serious. Attention to details tends to eliminate many "unexpected" failures.

Do You Know What

C. & O. Has Developed a Unit Cost System Which Gives Current Information on Its Operations

IN SPITE of the many studies which have been made and the extended time and effort which has been expended by various railways and railway organizations in an effort to put the different items of maintenance department work on a reportable basis subject to periodic detailed study and cost analysis, with the view of effecting economies through better performance and better work, many railways remain skeptical of the possibilities of maintenance cost analysis, and few roads have, therefore, done much with it. An outstanding exception to this attitude is the Chesapeake & Ohio, where skeptics have become enthusiasts, and where a thorough and comprehensive system of cost analysis has been in effect successfully since the beginning of 1926. Admittedly, the system on the C. & O. involves a large volume of work and costs considerable to keep in effect, but the beneficial results which have become apparent, coupled with savings in the cost of maintenance work far in excess of the amounts expended in maintaining the system, have demonstrated to that road that the system which it uses is entirely practical and effective, and that the cost and effort involved are more than justified.

Briefly, the practice followed by the C. & O., which is designated the "Unit Cost System," is a method for making efficiency and cost analyses with the primary purpose of effecting immediate economies in the handling of its maintenance work. Like many other systems advanced or tried out, this system is based primarily on the reports of the foremen, studies of existing conditions, and numerous time studies of actual operations, but, unlike many other systems, it employs a distinct and special group of trained engineers to carry it out, and is so designed that records are available currently rather than at widely separated intervals.

Specifically, the plan consists of a simplified method of reporting and describing the work performed so that the various items are readily classified, both as to time and quantities. After the intelligent application of modifying factors, the results are compared with unvarying standard rating schedules in terms of man-hours, which affords a standard base for periodic comparisons. In adopting this system, no changes were necessary in the daily time report forms previously in use, no additional work was imposed on the foremen, supervisors or clerical forces, and no interference whatsoever was allowed to exist between the newly created cost department and the authority of local officers.

As a result of the operation of the unit cost system on the C. & O., it has been definitely established that during 1926 there was a net saving to the company through better labor performance of approximately $51,240 on the fourteen supervisors' districts where it was in effect. In addition, the system has put the engineering and executive officers in closer touch with the details of the maintenance work carried on by the road, and has established a uniform

Track Officers and Foremen, Russell District, C. & O.
D. Hubbard, division engineer, top row eleventh from left; R. B. Grier, assistant cost engineer, second row third from left.

method of reporting on the part of foremen. This latter effect of the unit cost system has decreased the difficulties of timekeeping, reduced correspondence with the foremen, and increased the accuracy of account classification of labor and track materials.

The success of the system used on the C. & O. is due primarily to three general principles involved in the system itself: first, it is applied and handled by a trained force of engineers built up specifically for carrying out the system; second, it is based fundamentally on established standards of performance, that is, performances reduced to a common basis with due allowance for differences in conditions involved, such as a slightly varying character of work, the quantity of work carried out in a single unit, and such other modifying factors as climate variations, traffic densities and types of equipment used; and third, the system was adopted in a diplomatic manner to secure the confidence of the foremen, and has since been conducted in a similar manner until it has acquired their enthusiastic co-operation and has fostered a spirit of friendly rivalry among them in their desire to make a creditable showing.

Special Cost System Required for Making Detailed Analyses

The advisability, and in fact the necessity, of keeping cost data on maintenance work has been recognized by the C. & O. for some time. The most important question has been, however, whether the system adopted should be purely an accounting system, similar to the Interstate Commerce Commission's classification of accounts, sufficiently specific to identify the generalities of work and thereby form a basis for governing future economies or financing in a large way, or whether it should be a system involving a detailed cost analysis with the intent of accomplishing the same results, in addition to making it possible to check up periodically with the view of effecting immediate economies in large programs or in minor details while the work is still under way. If the latter results are desired, it was evident that the I. C. C.'s method of classification, or one similar

Your Work Is Costing?

Some of the Men Who Provide and Use the Cost Data
D. F. Ramsey, supervisor of track, top row fifth from right; W. H. Sparks, general track inspector, bottom row second from right

to it, is inadequate. This was apparent when it was considered, for instance, that I. C. C. account 220 includes the application of ties, rail, ballast and other track material, in addition to line and surface work, with its supplemental operations. This fact was further evident when it was realized that in the case of ties alone there are 216 separate and distinct grades of installations, a situation which made it plain that a thorough knowledge of costs could not be obtained from such a report, but must be derived from a more detailed and specific sub-division of accounts.

Recognizing this, the C. & O. adopted its own system of sub-dividing accounts and put its unit cost system into effect, for it was convinced that, notwithstanding the fact that railroad maintenance practices are well established, there is much room for improvement. More specifically, it believes that an investigation of any particular item of work will demonstrate readily that the average actual net rate of accomplishment is only about two-thirds of the possible rate of performance. Convinced that such a condition prevailed on its road as well as elsewhere, it formed its cost analysis department and set out to determine the causes underlying the estimated loss of one-third in the possible output of its maintenance forces.

Much Study Was Given to Organization and Account Classification

The establishment of the unit cost system on the C. & O. was made first on the Cincinnati division in April, 1925, and until September 1, 1925, organization was under way and a large number of time studies were made of actual operations to supplement data obtained from the time reports of the foremen. By the latter date, through a program of gradual expansion, there were 11 districts under observation, each of these districts (about equivalent to a supervisor's district) being in charge of an assistant cost engineer, reporting to the system cost engineer. On this date the cost system in use on the C. & O. at present was put into effect.

As previously mentioned, this system consists primarily of a simplified method of describing the work performed so that the items are readily classified, both as to time and quantities, and so that reporting, recording and comparison can be made accurately. This type of system was worked out, for it was evident that for any system to command respect and reliability it must be simple, and yet based on a uniform method of time reporting that will produce consistent accurate results. It was also evident that even the simplest system of account sub-division entails a multitudinous variety of figures, which unless handled by competent men will be of little value unless made available at short intervals so as to make possible immediate corrective measures if the reports should indicate that such are necessary.

In recognition of these facts, the question of account sub-division in the Chesapeake & Ohio's system was given much study in determining the relative weights of the individual maintenance work items. As finally worked out, only such items were selected for sub-account headings as were important from the standpoints of both quantity and repetition; this, however, included nearly 85 per cent of all work performed by the track forces. Governed by this principle, the following items were included in the C. & O.'s account classification:

1. Tie renewals
   1. Dug in
   2. With raise
   3. Side track
   4. Switch ties

   With sub-classification for each of
   (a) Unloading
   (b) Piling
   (c) Trucking
   (d) Installing
   (e) Disposal of old ties
2. Rail renewals
   1. Main track
   2. Repair rail
   3. Side track

   With sub-classification for each of
   (a) Unloading
   (b) Trucking
   (c) Laying
   (d) Uncoupling
   (e) Loading
3. Tie plate applications
4. Rail anchor applications
5. Rail joint renewals
6. Frog renewals
7. Switch point renewals
8. Guard rail renewals
9. Ballast
   1. Stone
   2. Gravel or cinder
   3. Side track

   With sub-classification for each of
   (a) Unloading
   (b) Raising
   (c) Dressing
   (d) Cleaning
10. Line and Surface
    1. Main track
    2. Side track
11. Respacing ties
12. Regaging rail
13. Tightening and renewing bolts
14. Banking
15. Ditching
16. Cleaning

The other 15 per cent of the work done by the maintenance department forces, such as mowing the right-of-way, snow removal, transportation account items, construction work items, etc., is suitably grouped under appropriate heads.

A review of the above classification will readily make apparent that the mere recording of quantities and time for each specific item is a matter of routine. This work is still further simplified on the C. & O. by the use of a special form (N-154), which is so designed as to provide for use either as a daily, monthly or yearly report, either current or progressive, and one which is at the same time suitable for section, district or system use.

Unit costs are also easily determined, but it was recognized that costs are not comparable unless made on an equated condition basis. For example, it was

Day, Month, Year, Section District or Division	Ballast																Line and Surface				Regaging	
	Cleaning		Unloading		Unloading		1st Raise		2nd Raise		Dressing		1-Stone		2-Gravel		3-Side track		Main track		Side track		Main track	
	Unit Cu yd	Man hours Total Av	Unit Cu yd	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit lin ft	Complete Manhr Av	Unit lin ft	Complete Manhr Av	Unit lin ft	Complete Manhr Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit each	Man hours Total Av
Total																						
Average																						

Day, Month, Year, Section District or Division	Tie Renewals																Rail			
	Unloading		Piling		Trucking		Installing		Burning		1-Digging in		2-With raise		3-Side track		4-Switch		Unloading		Trucking		Laying	
	Unit each	Man hours Total Av	Unit each	Man hours Total Av	Unit each	Man hours Total Av	Unit each	Man hours Total Av	Unit each	Man hours Total Av	Unit each	Complete Manhr Av	Unit each	Complete Manhr Av	Unit each	Complete Manhr Av	Unit each	Complete Manhr Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av	Unit lin ft	Man hours Total Av
Total																						
Average																						

Standard Form N-154 Which Is Used for Daily, Monthly or Yearly

plainly evident that digging in a tie in double track with stone ballast and the cribs full is far more costly than renewing a tie in single, gravel-ballasted track with the cribs only one quarter full. Even with unit costs available, it was evident that to convert these costs to a common basis would necessitate the constant publication of a multitude of comparisons, and that the results obtained would be too complicated for ready analysis. It was recognized also that practically the same confusion would result from comparisons of unit time, as each particular item reported would have to be converted to a common basis in order to afford accurate comparison.

To simplify this situation, a method of reducing all performances to a percentage basis was adopted, standard rating schedules in terms of man-hours having been established for all classes of work. These schedules were determined as a result of thousands of time studies on the C. & O. and on other roads, two-thirds of a possible day's work being established as 100 per cent performance. Regardless of the items of work under consideration, the schedules are so detailed that they may be modified to include additional work performed or to exclude items omitted, and notwithstanding the fact that track work is widely diversified, it has been demonstrated that it is not difficult to set up schedules which are both accurate and ready of application. A study of the system used on the C. & O. makes it apparent that it is not essential that each specific standard rating schedule be more than reasonably correct, as they form only a basis for comparison, but on the other hand, that it is necessary that a schedule, once adopted, remain without change so as to make possible correct periodic comparisons of individual items of work.

In carrying out the unit cost system on the C. & O., all of the details in connection with it are carried out by the foremen and by the specially created cost department. Recognizing the limitations of the foremen and the inadvisability of increasing the amount of clerical work for them to carry out, the system

Instructions for Reporting and Distributing Track Work Time Charges

Single Operations

Kind of Work	Manner of Reporting	Items to be Included
Lining—(Acct. 220-e)	State feet of track lined and whether main or side track.	Breaking down shoulder, lining track, replacing and dressing ballast.
Surfacing—(Acct. 220-e)	State total number of ties tamped and feet of track surfaced, whether tamping one or both ends of ties, number of ties, if main or side track.	Cribbing out, tamping, replacing and dressing ballast.
Gaging—(Acct. 220-e)	State number of ties gaged, whether with or without adzing and if main or side track.	Pulling spikes, plugging holes, adzing and respiking to gage.
Replacing Rail Joints—(Acct. 220-d)	State number, kind of joint and number of holes.	Removing old bolts and joints, placing new joints and full bolting.
Renewing Cross Ties—(Digging in Acct. 220-b)	State number of ties, with or without plates, and whether main or side track. If trucking, show number of ties, distance trucked, number of loads and number of flagmen used.	Carrying new tie, if less than 100 ft, cribbing out, removing plate, removing old tie, placing new tie, replacing plates, tamping, refilling cribs, dressing ballast, carrying and piling old ties for burning, if less than 50 ft. If new tie is moved more than 100 ft., or old tie is moved more than 50 ft., separate time consumed loading, unloading and trucking. If ballast is cleaned the time consumed should be reported separately.
Applying Anti-Creepers—(Acct. 220-d)	State number and kind, distance trucked, whether on hand or push car and number of flagmen used.	Moving ballast, applying anti-creepers and tightening. Separate time consumed loading, unloading and trucking.

Ties			Respacing			Tightening			Roadway																		Recapitulation						
Side track			Ties			Bolts			Banking			Cleaning			Ditching			Mowing			Snow and ice						M of W			C.T	Other depts	Grand total	Average hourly rate
Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit lin ft	Man hours Total	Man hours Av	Unit lin ft	Man hours Total	Man hours Av	Unit lin ft	Man hours Total	Man hours Av	Unit lin ft	Man hours Total	Man hours Av	Unit No to	Man hours Total	Man hours Av	Unit	Man hours Total	Man hours Av	Distributed Hours	Undistributed Hours	Total Hours	Hours	Hours	Hours	

Date or period ______________

Renewals															Other Track Renewals																							
Uncoupling			Loading			1-New			2-Repair			3-Side			1-Tie plates			2-Rail anchor			3-Rail joints			4-Frogs			5-Switches			6 Guard rails			Miscellaneous			Trucking		
Unit lin ft	Man hours Total	Man hours Av	Unit lin ft	Man hours Total	Man hours Av	Unit lin ft	Complete Man hr	Av	Unit lin ft	Complete Man hr	Av	Unit lin ft	Complete Man hr	Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av	Unit each	Man hours Total	Man hours Av

Report, Current or Progressive for Section, District or System

adopted limits to a minimum the amount of work required of these men. In fact, the same two forms used prior to the inauguration of the cost system have been adapted for use under it. These two forms consist of a material report and a daily labor report.

In the labor report, a section of which is illustrated herewith, the foreman makes a record in the usual manner, giving on the left half, the name, occupation, rate of pay and hours worked by each member of his gang, together with the total hours worked by the gang, which figure should appear at the bottom of the sheet. On the right-hand side of the report, the foreman indicates each item of work undertaken and the quantity performed, special conditions which may have existed in connection with the work, the number of hours consumed on each item of work, and the total hours worked, which figure should check with the total hours reported on the left side

THE CHESAPEAKE AND OHIO RAILWAY COMPANY N. 95

DAILY REPORT OF TIME EARNED AND DISTRIBUTION OF SAME

______________ Division Date ______________ 19____ ______________ District

Work Train Engine No.______________ Section Force Number______________

Work Performed by Work Train______________ Kind of Force______________

NAME	OCCUPATION	RATE	HOURS Worked		LOCATION AND DESCRIPTION OF WORK PERFORMED
				St. Time	
				Overtime	
				Overtime	
				St. Time	
				Overtime	
				Overtime	
				St. Time	
				Overtime	
				Overtime	

I have today employed the following men:

NAME	OCCUPATION

I have today requested discharge checks:

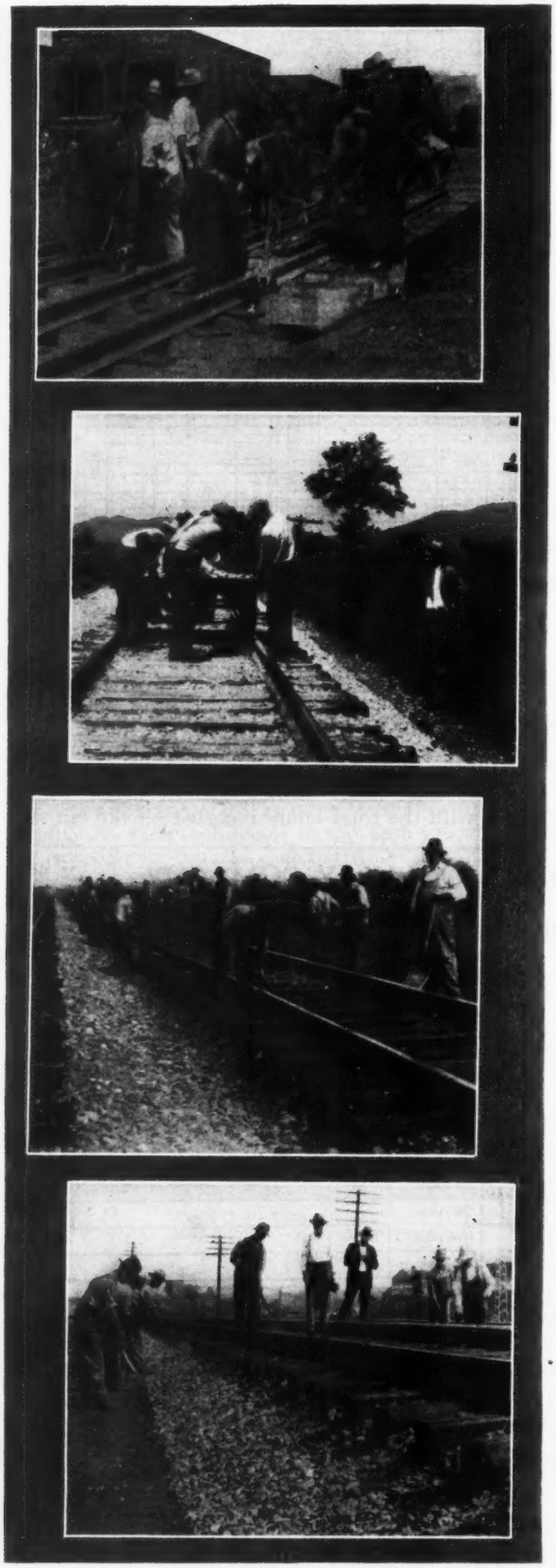
NAME	Hours Worked

______________ Foreman.

APPROVED:

______________ Supervisor.

Foreman's Labor Report Which Is Sent Daily to Assistant Cost Engineers



The Assistant Cost Engineers Make Time Studies of Various Operations Such as Tightening Bolts, Trucking Ballast, Cribbing Out and Filling Cribs Shown Above

of the form. To assist the foremen in reporting accurately and consistently the information required, special instructions were issued to each foreman in bound typewritten form, detailing for each class of work, the manner of reporting and the items to be included. These instructions cover not only the manner of reporting single operations but also combined operations and other department work. The accompanying items taken from the instructions for reporting single operations are indicative of the manner and completeness in which all of the instructions were prepared.

Governed by the instructions issued, the foremen fill out their labor reports and send them daily to the assistant cost engineer on their territory. With this information in hand the cost engineer makes a record on the special form adopted by the department (X-154), which is designed for itemizing individually the activity of each section or for summarizing the activity of all of the sections on his territory. This particular form, which is approximately 21½ in. long by 30 in. wide, includes headings for each of the account sub-divisions adopted in connection with the cost system, and has 38 spaces directly beneath each heading for recording the activity of a gang for each day of the month or for summarizing the activity of a number of gangs for any period.

Entries Are Made Daily

In making up this report for the activity of individual gangs, the cost engineer records for each day, under the proper headings, the number of units of each kind of work completed, the total man-hours employed, and the average time consumed per unit of measure adopted. All of this information is secured directly from the foremen's daily labor reports. Knowing the conditions under which each item of work was done, from the labor reports and from his own general knowledge of the conditions existing on his territory, the cost engineer then applies a standard schedule rating to the amount of each individual item of work and thereby determines the total hours which should have been employed for that quantity of work if it had been accomplished in accordance with the standard schedule rating. For example, a foreman might have reported the lining and surfacing of 330 lin. ft. of track in 64 man-hours, while the standard schedule rating for that particular class of work under the modifying conditions which may have existed might indicate that the standard schedule speed was 66 hours. This would indicate that the particular item of work was done in less than the standard schedule speed for that type of work. On the other hand, the standard schedule speed might show that too many man-hours were consumed in a particular unit of work.

In this manner, the work of each foreman is itemized daily in the office of an assistant cost engineer, so that at the end of a month it is possible to make totals and averages of the work performed, the cost involved, and the man-hours consumed by each particular section or extra gang. In like manner the activities of all of the sections on a district are summarized so that totals and averages can be made up for each class of work done on each district.

The information thus compiled by the assistant cost engineers is sent to the office of the cost engineer where further summarizing and compilations are made to show individually and comparatively the results being accomplished on each district and on the system as a whole. Among the other records kept by the assistant cost engineers, in addition to

the daily performance record of each gang and the monthly consolidated report of all gangs on their districts, are a monthly progress report of each gang and a monthly consolidated progress report of all gangs.

Accuracy of System Depends Largely on Cost Engineers

From the foregoing it is apparent that practically all of the responsibility for the reliability of the unit cost system on the C. & O. rests with the foremen and the assistant cost engineers. This is the situation, and yet a study of the duties and responsibilities of the cost engineers will show that it is their assistance to the foremen and supervisors, their intimate knowledge of their territories and of what is taking place on them, and their judgment in applying appropriate basic scheduled ratings or modified ratings, which determine the accuracy and consistency of the results obtained.

That the assistant cost engineers are in the best possible position to know of the work which is being carried on in their respective districts, best able to apply the proper standard scheduled ratings to the work accomplished, and at the same time are of much assistance in raising the standard of maintenance operations, is evident from the following summary of their more important activities:

They assist the supervisors in the planning of their work and in making special note of all miscellaneous or ungraded work.

They frequently visit the gangs and count the units of work performed on previous days in order to check the reports submitted by the foremen.

They prepare and keep up to date a record showing the type of roadbed, character of ballast, weight of rail and other characteristics of each section which might affect the planning and grading of work.

They assist the foremen in making reports and pay special attention to the work of each gang to see that all of the operations of the graded work are being performed.

They assist the supervisors in maintaining a continuous check on the quality of the work of each gang and in the observance of safety and other rules of the company.

They make detailed observation of the methods used by different gangs, and complete time-studies when necessary, so as to improve performance through the elimination of wasteful operations.

They make special reports of all studies pertaining to the organization and performances of the various gangs on different classes of work, and as instructions are issued from time to time covering methods and organizations, they assist the supervisors in securing uniform adoption.

Another important duty of the assistant cost engineers is to issue monthly bulletins to all foremen on their respective territories, advising them of the progress made by each foreman during the month and the relative standing of each foreman on his sub-division.

Performance Has Improved

With the activities of the cost engineers so broad and diversified it is not surprising that performance has improved on the C. & O., that wasteful methods are being stopped, and that the morale of the track forces is being raised. The outstanding advantages of the activities of the cost engineers from the direct standpoint of the unit cost system are that through actual training and observation in direct contact with the work, they are enabled to place a true value on the results being obtained and to check closely the reports of the foremen, and are further enabled to apply the proper rating schedules accurately to the various classes of work carried out, making allowances for delays and for additional items performed or special items excluded.

The entire cost department on the C. & O. is under the direction of the engineer maintenance of way and

Various Track Maintenance Operations Under the Observation of the Assistant Cost Engineer—Raising Track, Dressing Ballast Shoulder, Tamping and Dressing Ballast

heads up in the system cost engineer, to whom all reports are made. In his office, all data submitted by the assistant engineers, is summarized, this being arranged in both chart and tabular form to show directly for each district and for the system, the amount of work performed, the efficiency obtained, and the cost of carrying on the various items. Through this means comparison is made not only between the performances of the various districts, but also between the performances of the individual districts in carrying out the same operations from month to month or from year to year. Through further summary of the information submitted, system records are also made available for immediate use in checking expenditures, progress, and efficiency or for monthly or yearly comparisons. Some of the more important records kept by the system cost engineer include a condensed monthly review of the unit cost of track work, cost and efficiency record charts of each item of work performed, a table showing the monthly percentage standing of each district on all items of track work, a table showing the monthly percentage standing of the system on each item of work, and tables showing district comparisons of the unit time and the unit cost of each item of work performed.

Possibly the most effective method used on the C. & O. in presenting the results of performance, both for the individual districts and for the system, is graphically, as illustrated in the accompanying samples of the cost and efficiency charts of rail renewals on the C. & O. during 1926. On these charts the progressive costs of the various items are shown in the upper curve, month by month for the entire year, while the efficiency percentages attained month by month are shown in the lower curve.

In plotting the curves on these charts, the vertical scales for both curves are so equated that fluctuations are of the same value on either scale, i. e., laid out on the general assumption that efficiency alone governs costs. If this were the actual case, the curves would show equal fluctuations in opposite directions; however, it is obvious that there are factors which enter into costs which do not affect efficiency, and therefore the two curves are not diametrically opposite. As the efficiency curve is the more stable of the two curves, being the least affected by uncontrollable influences, this curve is the one best adapted for comparing the results being effected in the various classes of work carried out through the different months and seasons of the year.

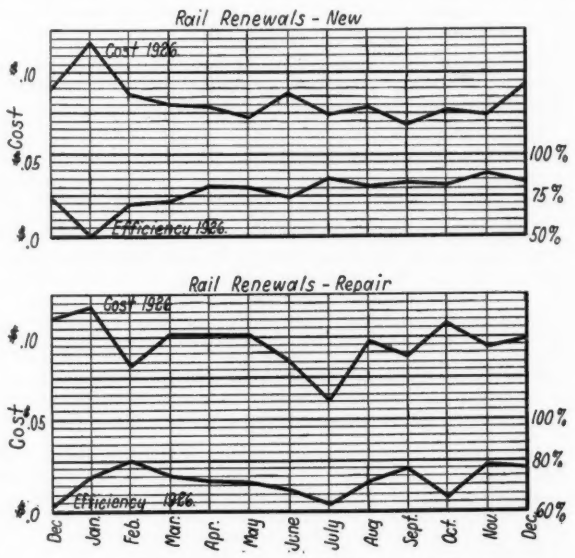
There are many ways of checking the accuracy of the unit cost system employed on the C. & O., and while error or deliberate misrepresentations might creep into the reports occasionally, consistent errors or misrepresentation are likely to be detected promptly. In the first place the cost engineers are specially trained to rate work uniformly and accurately, and are in a position to detect currently any errors or mis-statements of facts in the reports of the foremen. Likewise the system cost engineer, by comparison between the figures submitted by the various districts, is in a position to check the reports of the assistant engineers and to call for explanations of any fluctuations which may appear out of line.

Neither is it possible for poor quality of work to affect the efficiency ratings, except temporarily, for while slighting work, such as surfacing, might make it possible to obtain a high rating for a time, such a quality of performance would necessitate more frequently surfacing in the same territory, which would eventually show up on the various reports kept by the cost engineers.

System Produces Many Direct and Indirect Results

As a result of the application of the unit cost system on the C. & O. for more than two years, many beneficial results have been clearly demonstrated. The training and assistance which are being given to the foremen have increased the effectiveness of their work; the comparison of cost figures and efficiency ratings by the foremen has led to the more careful planning of their work and the closer supervision of its execution; the systematic thinking required by the cost system has had the tendency to eliminate unproductive labor, and on the contrary, stimulates the desire to conserve labor and material.

In a larger way the unit cost system has had a beneficial effect upon the supervisors who have the opportunity to consider the effects of rehandling materials, surplus work train service, excess travel of gangs, improper organizations of forces, surplus men on a job, etc. For the higher officers, the facts made available by the cost system make it possible to keep a close check on expenditures, the amount of



System Cost and Efficiency Chart

work performed, the efficiency with which the forces are operating, and innumerable details which few other systems would make readily available.

Another important direct result being effected through the unit cost system is the building up of a trained force through the assistant cost engineers. These men, when they have gained the necessary experience through direct contact with all phases of maintenance work, are in a much better position to serve in subsequent official capacities, for their judgment in matters pertaining to maintenance work will be based on actual facts and not upon personal opinion.

In addition to all of these advantages being brought about through the adoption of the unit cost system, it has been clearly demonstrated to the C. & O. that rather than being a system of theories, the system which they have in operation is a paying proposition, which during 1926 effected an actual saving of approximately $51,240. In arriving at this figure it was assumed that the general average of efficiency

represents the percentage of value received from each dollar spent, increases and decreases in efficiency being inversely proportional in loss or gain.

On this basis, using the payroll of measured hours on 14 districts for March, 1926, this month representing a normal month with a payroll of $148,720.83 and including only those operations subject to rating schedules, the results for the year were determined as follows:

The total cost of operating the unit cost system during 1926, including salaries, traveling expenses, printing, blue prints, etc., was $36,504.38, which, if deducted from the total gross saving effected, leaves a net balance of $51,240.92 as the actual saving for 1926, as a result of the installation of the unit cost system.

With the expansion of the system in January, 1927, to include 22 districts, which increased the work under survey by approximately 40 per cent, the saving effected during 1927 will be based on a payroll of about $2,450,900. Estimating the increased cost of handling the enlarged scope of the system at $49,680, and based on a minimum improvement in operation of 10 per cent over the system, it is expected that 1927 will show a net saving in maintenance labor expenditures in the neighborhood of $195,400.

In successive years, the C. & O. is of the opinion that still greater savings can be effected. Based upon an average normal performance of 75 per cent, the normal grading of section work to date has run from about 60 to 90 per cent. While it is not expected that all foremen have the capability of attaining the rating of the highest grade men, it is felt that it is not unreasonable to insist that those below the average normal performance rating of 75 per cent should at least attain that figure, which in itself would improve the general standing of the system by 7½ per cent.

Basic Payroll $148,720.83 **Basic Percentage 75.0**

Month	Rating	Percent	Saving
January	75.2	0.2	$ 297.44
February	76.7	1.7	2,528.25
March	78.2	3.2	4,759.07
April	78.3	3.3	4,907.79
May	79.7	4.7	6,989.88
June	79.4	4.4	6,543.72
July	80.6	5.6	8,328.37
August	80.9	5.9	8,774.53
September	81.5	6.5	9,666.85
October	81.9	6.9	10,261.74
November	84.6	9.6	14,277.20
December	82.0	7.0	10,410.46
Total			$87,745.30

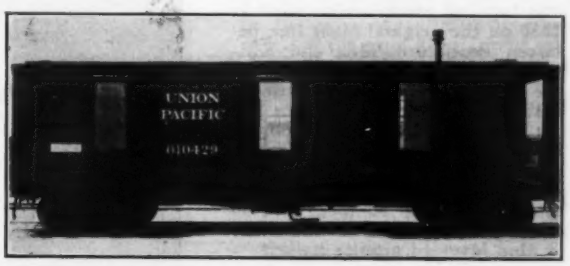
The cost system established on the C. & O. is not claimed as a cure for all maintenance ills nor a medium through which costs will be reduced and kept down automatically. On the other hand, it is viewed primarily as a vehicle in the hands of all maintenance department forces to record accurately the results being accomplished, to point out defects in handling work, and to suggest possible remedies. That the system has merit and is effecting definite results, is best evidenced by the wholehearted endorsement which it is receiving in all departments on the C. & O. from the foremen to the executive officers.

We are indebted for the information contained in this article, to C. H. R. Howe, cost engineer of the C. & O., who not only was instrumental in the planning of the system as used on that road and in the organization of the cost department as created, but who is in large measure responsible for the success which the cost system has attained.

Special Outfit Cars for the L. A. & S. L.

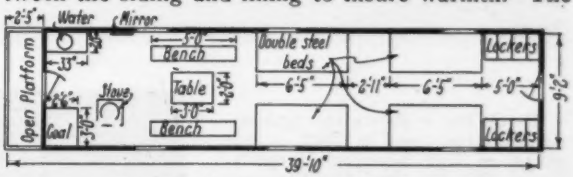
THE Los Angeles & Salt Lake unit of the Union Pacific has recently built at the Los Angeles, Cal., shops 100 bunk cars with 100,000-lb., capacity steel underframes and has also converted 10 dining cars, which were retired from passenger service, into mess cars for bridge and other work gangs. The comfort and safety provided by these cars add greatly to the morale of the men in the various gangs and thus tend to reduce the labor turnover.

The bunk cars have no center side doors, as is usual with this type of equipment, but instead have a vestibuled platform at one end of the car. The opposite end of the car has a door but the opening is provided with a stationary screen which will not permit entrance or egress of the occupants of the car, thus providing a safety device which prevents the men from stepping out between the cars while they are in motion and at the same time permits the door to be opened to obtain additional ventilation in hot weather. All doors and windows are screened.



One of the New Bunk Cars

Each car has a kitchen and lounging room in one end, equipped with two tables, four benches and a heating stove. The bunk room contains eight stationary steel bunks and eight individual lockers so that each man may have a private locker. The cars are thoroughly insulated with red rosin paper between the siding and lining to insure warmth. The steel underframes and heavy construction of the cars permit them to be handled with safety in any part of a train and thus obviate any extra switching en route.

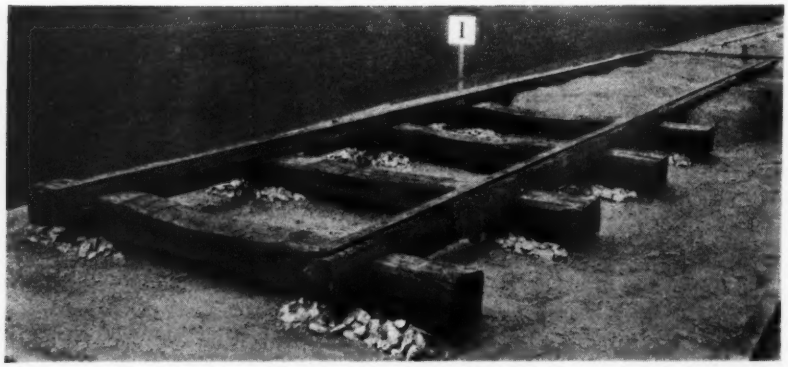


Interior Arrangement of Bunk Car

The mess cars are equipped with large refrigerators for storing meats, vegetables, etc., and each car has a living room, a large kitchen and a dining room. The cars are provided with overhead water tanks, and a cooking stove with a water back furnishes an adequate supply of hot water.

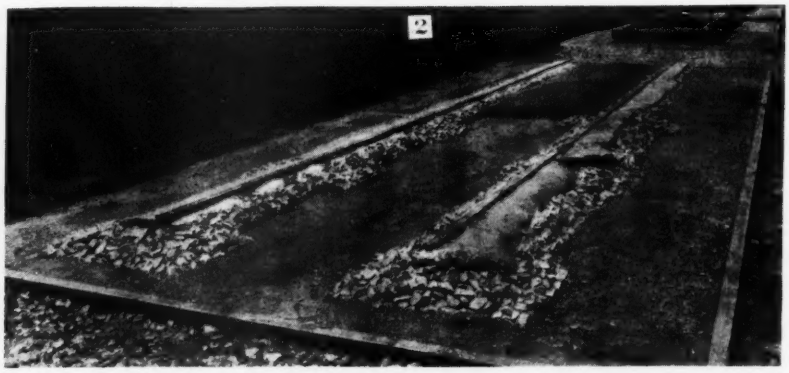
The Evolution of Track

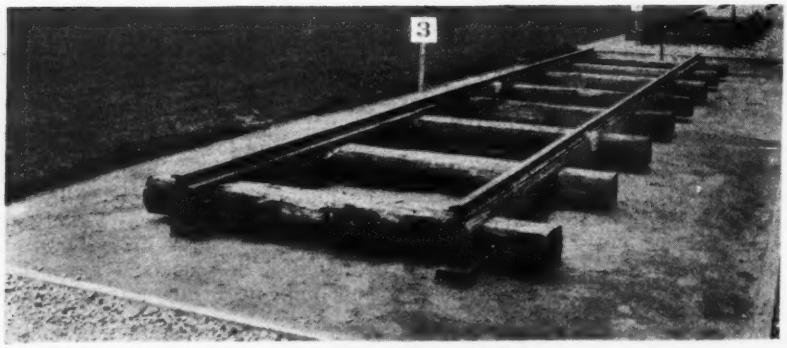
As Depicted in Exhibits Displayed at the Centenary



Track No. 1 represents the first type of construction used in 1830 on the original main line between Baltimore, Md., and Ellicott Mills. This track was built of iron strap rails, about 2½ in. wide and ⅝ in. thick, spiked at about 18-in. intervals to 6-in. by 6-in. stringers which in turn were notched into the cross ties. The cross ties were spaced about 3½ to 4 ft. apart and secured to the wooden stringers by means of wooden wedges driven on the inner side of the mortise.

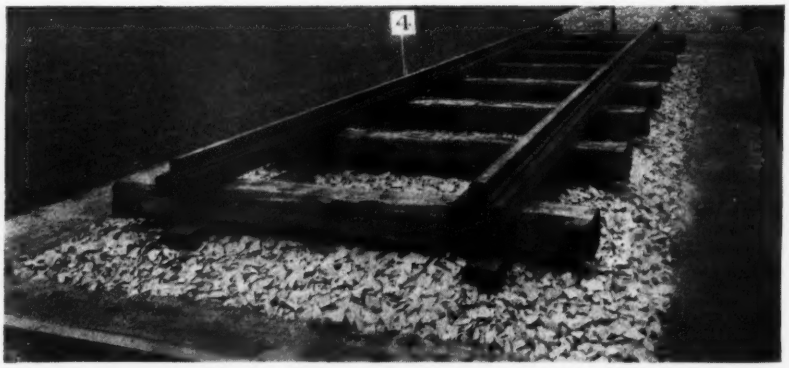
Track No. 2 represents the second type of construction used in 1830 on the original main line between Baltimore, Md., and Ellicott Mills. This type employed the same strap iron rails and spike fastenings as shown in Track No. 1, but with the rails supported on rough cut granite sills, which were about 12 in. to 18 in. across the top, 6 in. to 12 in. deep, and from 8 ft. to 10 ft. long. These sills were supported in a relatively thin layer of granite ballast





Track No. 3 illustrates the sill, tie, stringer and edge rail construction used in 1835 in the original main track between Relay, Md., and Washington, D. C. The bottom 6-in. by 6-in. sills, laid in a sandy ballast, supported 6-in. by 10-in. hand hewn ties which were notched to carry the 6-in. by 6-in. top stringers that supported the rails. This rail was the first step toward the pear-shaped and tee rails used later. It was furnished in lengths of about 15 ft. and weighed 40 lb. per yd.

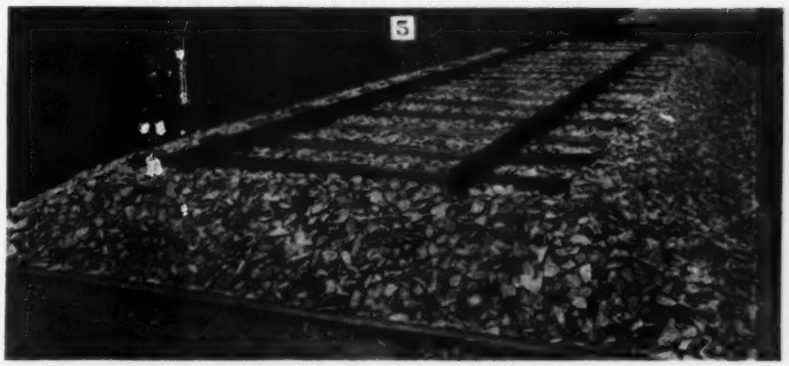
Track No. 4 shows the type of construction used in 1842 on 96 miles of line between Harper's Ferry, W. Va., and Cumberland, Md. This track was essentially the same as that designated as No. 3, except that U-shaped rails were used, and the bottom sills were suported on stone ballast. The U-shaped rail used in this track was the first rail manufactured in any quantity in America. This rail, which was spiked to the stringers with light-weight hook spikes, came in 20-ft. lengths and weighed 51 lb. per yd.



on American Railways

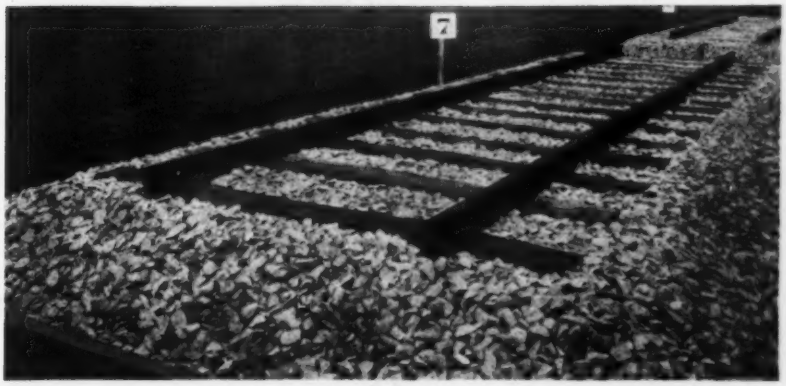
Exhibition of the Baltimore & Ohio at Halethorpe, Md.

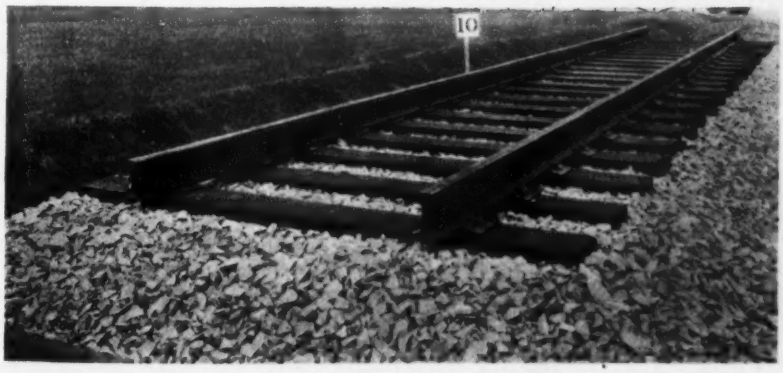
Track No. 5 represents the pear-shaped rail weighing 60 lb. per yard used in 1851 and 1852 in the original line between Cumberland, Md., and Wheeling, W. Va. This rail, which was made of iron, was spiked directly to cross ties laid in a deep bed of hand-knapped granite ballast. The rail was 3½ in. high and came in 20-ft. lengths. The rail joints were soft iron plates secured to the ties by four spikes.



Track No. 6 illustrates the type constructed in 1869 for the renewal of the older types. It is practically identical to that shown in the previous illustration except for the type of rail joint and the fact that the rail used was of steel instead of iron. This rail, which was pear-shaped, was rolled in England and was known as John Brown rail Its weight was 60 lb. per yard and it came in varying lengths up to about 30 ft. The joint consisted of wooden splice blocks bolted through the webs.

Track No. 7 is the oldest example on the Baltimore & Ohio in which rails of the modern T-section were used. It illustrates track laid in 1874 with rails weighing 67 lb. per yd. The joints consisted of angle bars and the rails were secured direct to the cross ties by cut spikes. Track Nos. 8 and 9 (not shown here) were examples of similar but heavier construction used in 1889 and 1908, in which the rail was of 85-lb. and 100-lb. section respectively.





Track No. 10, the last one in the exhibit, represents the type of construction used today on important main lines of the Baltimore & Ohio. It consists of 130-lb. R. E. section rail laid on creosoted ties. This standard was first used in 1921. The added feature in this construction is the tie plate which was illustrated in Track No. 9 with 100-lb. rail.

How to Make the Work Train Profitable*

Careful Planning and Co-operation with Other Departments Are Necessary to Avoid Wasteful Performance

By E. W. HAMMOND
Engineer Maintenance of Way, Buffalo, Rochester & Pittsburgh, Rochester, N. Y.

IN TIMES past a work train was commonly looked upon either as an essential part of a roadmaster's organization and indispensable to the accomplishment of his program of work or as an unmitigated nuisance with no right or privileges on the road. The difference of opinion depended upon the point of view, the maintenance of way men usually considering it an essential and the transportation men looking upon it as a useless encumbrance. The more modern view is to realize that a work train is at best a necessary evil which can only be justified when it can be kept busy every minute of the time it is on the road.

For this reason a constant effort is being made to find other ways of doing work on the road instead of using work trains and modern labor saving equipment has made it possible to curtail very considerably the use of such trains. There are, however, still many kinds of maintenance of way jobs for which work trains are indispensable and the problem is to keep them employed profitably when it is necessary to use them.

Close Co-operation with Transportation Department Is Necessary

To do this requires the closest co-operation between the maintenance of way department and the transportation department, for a work train standing on a siding while one or more gangs are idle for want of material or other service is wasting money at a rate not usually appreciated, even by railroad men themselves. As an indication of the expense involved in work train service, the cost of our engineering department for work train service in 1926 was $87,000, or an average of slightly more than $7,000 per month. The proper use of work trains is a benefit to the railroad at large and not simply to the particular department using it. A work train improperly or needlessly used is a waste of the company's resources and money. The attempt to use a work train at certain times and under particular conditions of dense traffic is uneconomical and should be avoided whenever possible.

To get the best use and results from a work train, a definite program must be arranged for each day and followed through. This requires careful planning by the supervising officer and close attention in the field by that officer or a competent representative. The planning of work train programs must include the line-up of cars and equipment to be placed in the train; the material to be loaded and unloaded; the force and supervision to be used; the starting time and the time and place for tying up or laying over. The co-operation of the transportation department is required in the operation of the train to insure a competent and experienced crew, prompt departure from the terminal at the exact time ordered and prompt and efficient movement during the day.

The engineering department officer responsible for a work train should avail himself of the knowledge and experience of the transportation department in the arrangement of schedules and avoid requiring an impracticable program which would be difficult to carry out on account of other necessary train schedules. Comparatively slight modifications in the arrangement of the program for a work train may mean avoidance of delay in starting and interference with the work during the entire day.

On the other hand, the transportation men should not overlook the important fact that a work train is a continuous source of expense to the railroad from the time it is ordered until it is tied up. It produces no revenue and can only be justified by producing a full and efficient day's work. To get this result some sacrifice frequently will be required in the movement of other trains and the work train should be favored wherever possible to do so.

An intelligent, experienced and wideawake conductor and a snappy engineer who is always on the job and does not have to be prodded to make a move, are blessings to a work train and mean a successful day. A delay of even a few minutes in making a single move may easily result in the loss of many hours of work. The intelligent use of a half hour's overtime at the close of a day may obviate the necessity for another train the following day, but on the other hand the loss in overtime paid to crew and laborers in the gang must be carefully considered, as that expense may easily eat up any saving made by the additional work accomplished.

Avoid Long Runs

Running trains a long distance from terminals to the work and back is a very wasteful practice and should be avoided. It is usually more economical to plan to use a train several days in succession, working from a nearby lay-over point, than to run out from a distant terminal for a single day's work. Reasonable co-operation between departments requires that the foreman or officer in charge of a work train should keep the conductor posted during the day as to the work to be done, giving plenty of advance information. The conductor, in turn, should keep the foreman continually advised as to expected opposing train movements which will affect the work train. This will make it possible to use to advantage all the time available for actual work and avoid idle time waiting for delayed trains or running to and from sidings unnecessarily.

The accomplishment of a work train can be very largely increased wherever it is possible to give it authority to move within certain limits against other trains and to allow it to work up to the time opposing trains actually show up, rather than to require the work train to wait in the clear until opposing trains go by. This applies, of course, only to other than first-class trains and very important through freight runs. From the standpoint of econ-

*A paper read before the July staff meeting of the B. R. & P. and printed in Railway Life, published by that road.

omy to the railroad (and that is the most vital matter to all of us), it is usually better to delay an ordinary revenue train a few minutes than to cause a work train to lose several times as much time when perhaps 50 or 60 men are also losing time waiting for service.

Arrangements for the return run from the work to the terminal or lay-over point should be made early enough in the day to allow a good schedule and thus avoid overtime for gangs and train crew for which there can be no return value. In many cases small amounts of work train service at outlying points can be performed economically by regular local trains and thus reduce the number of work trains required. It would be folly to claim that such local service can be furnished without cost of transportation and some delay to the local trains, but the question here again is one of ultimate economy to the railway as a whole. When such service is requested, it should be considered by the responsible officers of the interested departments in the broad light of net results for the company.

Safe Practices Must Be Followed

The element of safety is of the utmost importance in the use of work trains, and foremen and conductors in charge should be continually alert to see that all equipment used is in proper condition and that employes working on or around the train are safeguarded against personal injury. Trains should not be moved until warning has been given to all employes, and signals to move the train should be given only by the conductor or a delegated trainman and engineers should not act on signals given by foremen. The engineering department rules require that men must be seated while the train is in motion and that all men are out from under and between cars before the signal to start is given. Flying switches with cars containing men must not be allowed. Equipment containing workmen must not be pushed ahead of the engine for any great distance, and when running to and from work, cars containing workmen should be handled behind the engine and next to the caboose.

Failure to Take Precautions Causes Motor Car Accident

ON JULY 21, 1927, a light engine on the Chicago Great Western collided with a motor car and weed mower near Cannon Falls, Minn., causing the death of five men. The accident occurred within yard limits on a four-degree curve in a cut above four feet deep, but owing to a heavy growth of tall weeds at the top of the cut slopes the view of the track from an engine approaching from the east was restricted to about 100 ft. on the engineman's side and 200 ft. on the fireman's side.

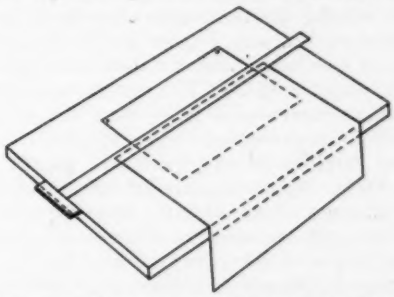
The motor car involved was a heavy duty car weighing about 1,200 lb. It was hauling a push car on which a mowing machine had been mounted and at about 4:10 p. m. this equipment, manned by a track supervisor, a section foreman and three trackmen, was being employed to mow weeds while moving eastward out of Cannon Falls. The men on the motor car and the mowing machine were apparently so engrossed in the work being done that they failed to note the approach of a light engine from the east until too late to avert a collision. According to the report of the Bureau of Safety of the Interstate Commerce Commission, investigation showed that the section foreman had asked for a line-up of the trains at 8 a. m. but took no steps to have this brought up to date at any time during the day.

The engineman testified that his engine was traveling at about 25 miles per hour at the time he first saw the motor car, but the fact that it was not brought to a stop until it had pushed the motor car and trailer 693 ft. is taken as indicating a considerably higher speed. The testimony also brought out that only three men were required to operate the mowing machine outfit and that in consequence there was no reason why two of the crew of five might not have been employed for flag protection as definitely required by the rules of the Chicago Great Western governing the operation of motor cars in the absence of a line-up when operating the cars around curves or other dangerous places. The report definitely places the responsibility for the accident on the track supervisor and the section foreman as well as on the engineman for failure to operate his engine under control within yard limits.

How to Keep Drawings Clean

By Joe Brejcha, Jr.

WHEN a considerable amount of time is required to complete a drawing the draftsman will find that it is almost impossible to keep it clean, due to the smutting of pencil lines which results from moving the T-square up and down and from brushing



The Sheet of Tracing Paper Protects the Drawing

the arm back and forth across the paper. If the drawing is to be inked in, it can be cleaned with a sponge eraser, but if the drawing is not to be inked in it is almost impossible to clean it. I have found that a piece of tracing paper a little larger than the drawing pasted to the under side of the T-square will serve as a screen or curtain that moves up and down with it. While this does not keep the drawing spotlessly clean, it helps me to turn out a neater drawing.

The Lackawanna Limited

The Total Attendance at the Convention Was About 600

The Bridge and Building Convention Establishes New Records

Attendance, Interest in Program and Membership Reach New High Levels; Discussion Unusually Active

AN ATTENDANCE exceeding that of any previous meeting, a program that aroused more than usually active discussion and a larger and more attractively displayed exhibit were outstanding features of the thirty-seventh annual convention of the American Railway Bridge and Building Association, which was held at the Nicollet Hotel, Minneapolis, Minn., on October 18-20. The registration of 240 members was an increase of more than 10 per cent over the previous high record, while the total attendance, including families of members and supply men, approached 600. Approximately half of this number gathered at Chicago on the Monday morning preceding the convention and traveled to Minneapolis together on a special train of 11 cars provided by the Chicago, Burlington & Quincy. A feature of special interest at the meeting was the presence of 13 of the 22 living past-presidents of the association, headed by W. A. McGonagle, president of the Duluth, Missabe & Northern, who presided over the 1896 convention.

The program was of more than usual interest and the discussion active. In addition to the presentation of reports by eight standing committees, addresses were made by Ralph Budd, president of the Great Northern, by U. K. Hall, general supervisor of stores, Union Pacific System, on The Control of Emergency Material Stocks, and by J. W. Porter, special engineer, Western lines, Canadian National Railways, on The Water Supply Problem of the Northwest. On Tuesday evening C. R. Knowles, superintendent of water service, Illinois Central, presented a paper on Fighting the Mississippi River Flood, illustrated by slides and moving pictures. Abstracts of these papers will be published in following issues.

Officers of the Association

The officers in charge of the activities of the association during the last year were as follows: President, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago; first vice-president, F. C. Baluss, engineer of bridges and buildings, D. M. & N., Duluth, Minn.; second vice-president, Maro Johnson, assistant engineer, I. C., Chicago; third vice-president, J. S. Huntoon, assistant bridge engineer, M. C., Detroit, Mich.; fourth vice-president, C. S. Heritage, bridge engineer, K. C. S., Kansas City, Mo.; secretary-treasurer, C. A. Lichty, inspector, purchasing department, C. & N. W., Chicago; assistant secretary, F. E. Weise, chief clerk to chief engineer, C. M. & St. P., Chicago; directors: A. I. Gauthier, bridge and building supervisor, B. & M., Concord, N. H.; E. L. Sinclair, assistant engineer, C. M. & St. P., Marion, Iowa; O. F. Dalstrom, engineer of bridges, C. & N. W., Chicago; W. T. Krausch, engineer of buildings, C. B. & Q., Chicago; R. C. Bardwell, superintendent of water service, C. & O., Richmond, Va.; and H. I. Benjamin, assistant engineer, S. P., San Francisco, Cal.

R. H. Aishton Made an Honorary Member

The report of C. A. Lichty, secretary, showed the present membership of the association to be in excess of 750, the income during the year to have been $5,002 and the balance on hand October 1 to be $1,001. He also reported the election of R. H. Aishton, president, American Railway Association, as an honorary member, the first time in the history of the organization that this recognition has been accorded to any man.

At the concluding session of the convention on Thursday morning, the Committee on Subjects presented the following topics for consideration during the ensuing year and report at the next convention: (1) The relative merits of jacking or tunneling through a roadbed under traffic, as compared with other methods of placing culvert pipe; (2) the use of motor trucks for handling bridge building materials and supplies; (3) the construction and placing of concrete unit-built slabs for various purposes; (4) the control of motor car operations with respect to the prevention of accidents; (5) the organization and equipment for handling emergency bridge, building and water service work; (6) means of promoting co-operation between store department and field forces; (7) the wrecking and salvaging of railway buildings; (8) the economical operation and maintenance of water stations; and (9) painting the interior and exterior of railway stations, freight houses and other allied buildings.

At the same session the following officers were elected for the ensuing year: President, F. C. Baluss, engineer

Many of the Members Were Accompanied by Their Families

of bridges and buildings, D. M. & N., Duluth, Minn.; first vice-president, Maro Johnson, assistant engineer, I. C., Chicago; second vice-president, J. S. Huntoon, assistant bridge engineer, M. C., Detroit, Mich.; third vice-president, C. S. Heritage, bridge engineer, K. C. S., Kansas City, Mo.; fourth vice-president, A. I. Gauthier, bridge and building supervisor, B. & M., Concord, N. H.; secretary-treasurer, C. A. Lichty, inspector, purchasing department, C. & N. W., Chicago; assistant secretary, F. E. Weise, chief clerk to chief engineer, C. M. & St. P., Chicago; directors for two years: R. C. Henderson, master carpenter, B. & O., Dayton, Ohio; T. H. Strate, engineer of track elevation, C. M. & St. P., Chicago; John S. Ekey, supervisor of structures, B. & L. E., Greenville, Pa. In addition the following directors hold over for another year: W. T. Krausch, engineer of buildings, C. B. & Q., Chicago; R. C. Bardwell, superintendent of water service, C. & O., Richmond, Va.; and H. I. Benjamin, assistant engineer, S. P., San Francisco, Cal.

Boston was selected as the location of the next meeting.

Inspection of Ore Docks at Duluth

Shortly after the adjournment of the convention on Thursday noon, more than 450 of those attending the meeting were taken to the plant of the American Hoist & Derrick Co., St. Paul, Minn., where a unique lunch was served the "bridge gang" in the engine erecting shop, the party being provided with working cards and punching a time clock before being given workmen's dinner pails, and "paid off" at the conclusion of the lunch in German marks of high denomination, after which they inspected the plant and witnessed demonstrations. On Thursday evening nearly 300 persons boarded a special train of 10 sleepers provided by the Great Northern and the Duluth, Missabe & Northern for an inspection of the Missabe iron range, visiting the Hull-Rust open-pit mine at Hibbing Minn., and the D. M. & N. docks at Duluth, concluding with a dinner in the evening given by W. A. McGonagle, president of the Duluth, Missabe & Northern, and H. Johnson, president of the Duluth & Iron Range. At the conclusion of the dinner the Chicago & North Western provided a special train of seven sleepers for those returning to Chicago.

The convention was welcomed to Minneapolis by W. H. Bremner, president of the Minneapolis & St. Louis, who referred to the fact that this year marks the one hundredth anniversary of the granting of a charter in this country to a company that was to operate exclusively as a railroad. "It was two years after this charter was granted," he said, "before actual operation commenced and then we read that an engine with a full-tonnage train behind it might be expected to operate at a rate of 4 miles per hour, or with half-tonnage at 12 miles per hour. From this small beginning we have progressed until today we have some 260,000 miles of lines and our railroads, looked upon 100 years ago as mere adjuncts to water transportation, have become the breath of life to this nation. It has been said that easy transportation for men and goods makes a nation strong and great and certainly that is true in the case of the United States. It is our railroads that have made this the most prosperous nation in the world and you and I should be proud of the fact that our lot in life has made us a part and parcel of this great system of transportation. It was the bridge engineer who made possible the construction of these great railroads by finding a way to bridge our streams and to carry the rails in and out along the edges of mountain chasms. You men play a very important part in railroad work, for it is in your care that the lives of millions of passengers and the safety of billions of tons of freight is entrusted."

W. A. McGonagle, senior past-president of the association, responded to Mr. Bremner on behalf of the association, reviewing the earlier history of the association from the time when it first organized in St. Louis in 1891 and relating many incidents regarding the earlier members. "May we give due credit in the future," he said, "as we have in the past, to those pioneers who led the way to the successful organization of which we are now members and which has been of great benefit to the public in providing a safe roadway upon which they can travel. I give much of the credit for my advancement in railway service to the early lessons of thoroughness and practical methods that I learned from my associates as a worker with them in this association."

President Howson Reviews Work of Year

In reviewing the work of the past year President Howson referred particularly to the improvement that was effected in the association's financial affairs and to the aggressive campaign for the collection of dues, as a result of which more than 700 members are now in good standing, a larger number than ever before in the history of the organization. He also reported that 67 new members had been elected during the year.

He then referred to the comment sometimes expressed that there are too many railroad associations, which comment implies a duplication of effort between the various organizations. He spoke on this point in part as follows:

There are now three active associations in the engineering and maintenance of way branch of railway service, the Roadmasters' Association, the American Railway Engineer-

ing Association and the Bridge and Building Association. Obviously, there is no duplication of work between the Roadmasters' and our association. The only possibility for conflict lies between these two associations and the American Railway Engineering Association, which latter organization, by the way, is the junior of the others by more than ten years. At first glance, there might appear to be a possibility of conflict between the work of the Committees on Iron and Steel Structures and on Masonry of the American Railway Engineering Association, for instance, and of our association. Yet a review of the work of these associations for the last quarter of a century does not bear this out. A perusal of our activities will show that they have been confined consistently to the consideration of the practical field problems of bridge and building maintenance and that in no case has an attempt been made to consider problems of design, draft standards or dictate policies. The work of the American Railway Engineering Association, on the other hand, has started where our work has ended and has continued through the problems of design, of standards and of the determination of system policies. This organization is doing a work which we as a group are not prepared to perform. On the other hand, it is equally true and no reflection on the A. R. E. A. to state that as a group the members of that association are unqualified to pass on the more local but equally important problems that arise in the conduct of operations in the field. The magnitude of the railway industry and the constantly changing character of its problems are such as to make necessary the two types of experience and to fix equally definite places for the two associations, each studying its peculiar problems and correlating its activities with those of the other group.

There is still another phase of this problem to be considered. It is a trite but true saying that one profits from an association in direct proportion to what he puts into it. In other words, he benefits in direct relation to his activities. The greatest benefit from association work will, therefore, come to a road whose officers are most active in its work. For a man to secure the largest benefit from an organization such as ours, this organization should be composed of men of as similar interests as possible, in order that he can exchange information with them freely and draw information of help to himself from them. This is not practical in an organization of widely differing ranks, particularly when an industry takes on as much of a military nature as a railway, for a man in a subordinate position will not feel free to take issue with his superior officers in a public meeting, but will remain quiet, depriving the association of the benefit of his experience and at the same time dampening his own interest until he drops out, with the ultimate result that the combination of associations results merely in an organization of the more important heads of departments.

If, on the other hand, men of local rather than system rank have an opportunity to compare ideas with their fellows, experience has shown that they will take advantage of this opportunity with the result that they will bring back to their roads new and better ideas of attacking their own problems, which are just as valuable in their way as other new ideas are to their system officers.

Ralph Budd Addresses Convention

Ralph Budd, president of the Great Northern, addressed the convention on Wednesday forenoon, referring particularly to that railway's historic stone arch bridge across the Mississippi river at St. Anthony Falls, just outside the Minneapolis Union station. This structure, which is 2,100 ft. long and built for double track, consists of 23 arches varying from 40 ft. to 100 ft. in span, and is on a tangent, with the exception of 900 ft. at the west end, which is on a 6 deg. curve. It is believed to be the oldest railway bridge across the Mississippi river that has never been strengthened or altered and that is still carrying main line traffic. The only older railway bridge across this river is the Eads bridge at St. Louis, the floor system of which has had to be strengthened.

"As I have come to know more about the work of James J. Hill," Mr. Budd said, "I have come to look more and more on this old stone bridge as a monument to the faith that he had in the Northwest. He started planning this bridge in 1880 and it was built in 1882-3, whereas he had only taken over the old St. Paul &

ELMER T. HOWSON
President

Mr. Howson has been a member of the American Railway Bridge and Building Association since 1911. His election to the executive committee in 1919 was followed by his promotion to fourth vice-president with subsequent advancement through the chairs to the presidency. His association with the Simmons-Boardman Publishing Company dates from February 1, 1911, when, following several years' experience in railway engineering, including that of division engineer on the Chicago, Burlington & Quincy, he was appointed engineering editor of the Railway Age, being made western editor in 1919. In 1916, when the predecessor of Railway Engineering and Maintenance was acquired by the publishers of the Railway Age, he was also appointed editor of that paper.

Pacific from receivership in 1878 and the country to the west was not yet developed. The locomotives and cars that this structure now carries are now more than three times as heavy as the heaviest equipment then in use."

Mr. Budd called attention to the fact that one of the piers of this structure contains a granite block, bearing the inscription:

"James J. Hill, president; A. Manville, vice-president, Charles C. Smith, engineer; Ed Darrow, contractor,"

this being the only structure on the Great Northern on which Mr. Hill ever permitted his name to be placed.

Mr. Budd congratulated the association on the serious character of the program and offered as a suggestion for reduction in costs the experience of the Great Northern which, within the last 12 months, has installed approximately 50 motor trucks for the handling of bridge and building and other materials in terminals and on construction work, thereby keeping the men off busy terminal tracks and eliminating interference and accidents.

Mr. Budd also congratulated the association upon the attention which was given to safety, stating that "the program which the American railways have set for themselves in reducing accidents by 35 per cent between 1923 and 1930 is being improved upon. The statistics that I have seen indicate that in bridge and building work the reduction of accidents per million man hours is keeping pace with the average of railway accidents as a whole."

Materials for Highway Bridge Floors

THE PROBLEM of selecting materials for highway bridge floors has assumed a new importance in recent years, owing to the rapid change in the character of the traffic which such structures are called upon to carry and also the decline in the quality of the timber which until recently was used quite generally for bridge floors. Because of these changes, this subject was assigned to a committee for study. After citing the practices of a number of roads the committee drew the following conclusions:

In discussing the relative merits of various materials for floors on highway bridges it is necessary to consider also the methods of constructing not only the floor itself but in some cases the entire floor system. It will be readily recognized that the best floor is that which has the least chance for vibration, is watertight and fireproof. A smooth surface is essential to the reduction of vibration but a smooth surface can not be maintained over a floor system which is improperly designed.

There is no doubt but that in view of the common knowledge of present day traffic conditions and its trend, the concrete floor over a properly designed substructure meets the above requirements better than anything else. This means that the unit stresses of the floor system must be kept low, the reinforcement of the floor slab and the expansion or contraction joints be designed in accordance with the best practice known and that the concrete itself be proportioned and mixed with the utmost care. For heavy traffic conditions the concrete slab should be waterproofed and a wearing surface of either concrete, asphalt or brick used, depending on local conditions as to the ease with which these materials can be obtained and handled, and the grades on the structures. Good brick laid with an asphalt filler is likely to give a wearing surface of long life. Asphalt has excellent riding qualities where grades permit but, except where proper facilities are at hand, is liable to prove costly when repairs become necessary. On the whole, a concrete wearing surface, independent of the floor slab is likely to be more acceptable generally.

For medium or light traffic conditions on secondary highways, the concrete slab itself, without the addition of a wearing surface, should prove entirely satisfactory provided proper conditions of design and construction are adhered to. If wear or cracks develop they can be taken care of with an application of one of the several kinds of bituminous materials such as rock asphalt, tarvia or asphaltic concrete, but care should be taken to see that this is done in time so that the floor may be kept watertight. Of course, a first class concrete floor, such as is recommended, will be high in first cost but we believe that the added cost will be more than offset by the lack of maintenance cost and the inconvenience encountered in maintaining any other class of floor designed for heavy or medium traffic.

For light traffic conditions where the entire structure is to be new or renewed, we strongly recommend that the more permanent concrete floor should be used in preference to the best wood floor. Of course in many cases this will require a better substructure than would be called for in using a wood floor, and to many the cost would seem out of proportion. However, it is believed that under ordinary conditions a better structure consisting of steel substructure and concrete floor would cost little more than a steel structure with wood floor taking into account the added amount of steel required to carry the concrete floor. Certainly the additional cost would be wiped out by renewals in a comparatively short time. In many cases existing steel bridges might, without undue expense, be reinforced to carry a concrete floor.

When the concrete floor is not considered economical for existing structures or for other reasons wood floors must be retained, we recommend a treated sub-floor of not less than 3 in. in thickness and a wearing surface of not less than 2 in., both courses of plank to be dressed to a uniform thickness and laid in such a manner as conditions or local preference may require.

The committee is agreed that in the repair of existing floors, instead of the too prevalent and costly method of frequent replacements of plank in kind, more consideration should be given to making such floors as permanent as possible and suitable to present day conditions.

The use of thick flooring material permits wider spacing of stringers thus reducing the pockets under the floors, consequently the gases from locomotives will be more quickly dispelled.

A good bituminous surfacing is recommended on wood floors, which surface should be of such material as will compact well and should be from 1 in. to 2 in. in thickness. Materials commonly known as asphaltic concrete or similar materials are available which, if properly placed, will be found advantageous in making a smooth riding surface and a watertight floor.

(Two appendices accompanied the report, Appendix A consisting of the specifications for asphalt macadam of the Southern Pacific, while Appendix B was an article entitled "Concrete Compared with Timber for Highway Bridge Floors," by A. L. Grover, bridge engineer, Bureau of Public Roads, which appeared in the October, 1926, issue of Public Roads, published by the United States Bureau of Public Roads. In the article an analysis is made of the cost of concrete and timber floors and several cases are cited in which the cost of each type of floor is shown.—*Editor.)*

Committee: John S. Ekey (B. & L. E.), chairman; J. S. Huntoon (M. C.), vice-chairman; H. H. Harman (B. & L. E.); J. D. Voorheis (Wabash); F. W. Hillman (C. & N. W.); J. W. Holcomb (L. V.); J. A. Bohland (G. N.); R. E. Sheehan (C. B. & Q.), and A. Fink (D. L. & W.).

Discussion

F. C. Baluss (D. M. & N.) took exception to statements to the effect that planking laid crosswise or diagonally with traffic is more easily repaired, stating that his experience had been that planking laid in the direction of travel will give four to five times as long wear as when laid crosswise. Furthermore, planking laid longitudinally will wear more uniformly. J. Huntoon (M. C.) expressed fear regarding longitudinal planking on steep grades because of the fact that it will become slippery. G. W. Rear (S.

P.) cited unsatisfactory experience with the application of asphalt on creosoted timber because of the necessity of applying the asphalt hot which causes the creosote to boil out of the wood and create gas pockets in the asphalt. A. I. Gauthier (B. & M.) stated that, as a result of the breaking of many planks in recent years, it has become necessary to either place the stringers closer together or to add an additional layer of planking as a wearing surface. He advocated the use of two-inch untreated planking on a three-inch creosoted subfloor carried on creosoted stringers. By this construction, Mr. Gauthier contended that it is possible to increase the service from the stringers by decreasing the spike killing.

Excavation for Foundation Work

BECAUSE of the diversity of the problems encountered by bridge and building forces in excavating for foundations, the committee presented an extended report in which it described different methods adapted to problems of various kinds. Owing to the length of this report, it is possible to give only a comparatively brief abstract of it as follows:

The most important feature in making excavations is to determine first the depth to which the foundation bed must be carried. This depends upon the allowable bearing on the foundation bed, and the location of the scour line, if near water. Where running waters may affect the foundation of a structure so that there may possibly be erosion or scouring of the foundation bed, it is of extreme importance that the foundation bed be placed below the scour line, so that no scouring or undercutting will take place under the most aggravated conditions. Frequently protection is given the foundation bed by placing heavy rip rap around the structure at the ground line.

Ordinarily, the engineering department of the railroad determines the depth to which the foundation bed must be carried, but the bridge and building supervisor in charge of the work should take it upon himself to check the foundation bed to make sure that it is of sufficient depth and of satisfactory material.

When making large excavations, such as bridge piers and abutments, etc., where a small amount of water is encountered, the first item to be considered is the support of the track structure so as not to interfere with ordinary train operation. A temporary pile trestle is usually employed rather than blocking up the track, as it is safer and does not need constant attention. The bent-work may also be used for shoring up the sides of the excavation. Before determining upon the method of handling the excavation, the equipment available should be considered. If work equipment is available, i. e.—equipment mounted on wheels and operated on the rails, a spur track close to the scene of the work is almost indispensable, even though it may be necessary to construct a temporary spur. This work equipment may then be placed in the clear quickly and train operation not interfered with. The cost of work trains and delays incidental thereto, is so great that they should be used as little as possible where work is being performed under traffic.

The most common labor-saving devices are derricks with booms long enough to dispose of the excavated material properly withaut rehandling. These derricks should be installed alongside the excavation and a three drum hoisting engine with swinging gear, should be used with them. They have the advantage that they can be used not only for excavation, but also for driving sheet piling and supporting piles and placing concrete. With this method train operation is not interfered with and flagmen are not necessary.

One of the most satisfactory types of equipment is the self-propelling locomotive crane, sometimes used with air-dump cars, where material is to be taken away from the excavation and disposed of. The bucket used in conjunction with either the derrick or crane is dependent upon the nature of the soil to be excavated. In cases where the clay is of such a character that digging with a bucket is impracticable, air operated shovels have been used to cut the clay into lumps so that it may be loaded into buckets by hand.

F. C. Baluss is engineer of bridges and buildings of the Duluth, Missabe & Northern, a position he has held since 1914, after previous service as draftsman and assistant engineer. He was elected a director in 1921 and became a vice president in 1923.

F C. Baluss
First Vice-President

Maro Johnson became a member of the executive committee in 1921 and was advanced to vice-president in 1924. He has been a member of the Illinois Central's engineering staff since 1898, being employed in bridge work for a large part of his railway service.

Maro Johnson
Second Vice-President

Where work is carried on during the summer or low water period and the excavated material is stable with little seepage from nearby waters, the excavation can be kept reasonably dry by the use of pumping equipment without resorting to sheet piling. Centrifugal pumps appear to be the most effective, because of their efficiency and ability to handle solids without becoming clogged easily. Reciprocating duplex steam pumps, diaphragm pumps, steam siphons and pulsometers have also been used, the three latter when comparatively small amounts of water were to be handled. In one case where the lift was too great for a steam siphon, an injector from a large locomotive was used to raise water about 40 ft.

In one case on the Elgin, Joliet & Eastern, where work was being performed in sand saturated with water, cave-ins were prevented by installing a series of well points outside of the area to be excavated to a level a little below the proposed foundation bed. These were connected to pumps and the ground water level was lowered around the area to be excavated so that little, if any, other than ordinary bracing was required to prevent cave-ins. In this way the excavation was made and the concrete poured in the dry.

Under-Water Excavations and Sheet Piling

Coffer-dams are most commonly used to protect excavation work and the placing of concrete. Tongue and grooved Wakefield type wooden sheet piling is one of the oldest methods used and if constructed properly, it is satisfactory and economical, as timber sheathing of a good thickness gives great strength at a small cost. This wooden sheathing is sometimes

constructed in double rows with a minimum interval of about two feet and puddled with clay to make it water-tight.

Present day practice is tending more and more to steel sheet piling, on account of the ease of driving, especially through the harder materials, and the possibility of being able to pull the piling and using it over again. The piles are of the interlocked type and consequently have the advantage of following the adjacent pile. The joints are usually filled with clay or similar material to make them watertight. The Canadian National recently experimented with a single row of piling, filling the joints with wheat, which swelled and closed the joints practically watertight with satisfactory results. Care had to be exercised, however, not to jar or disturb the piling. Dry cement has been used for closing the joints but this is not recommended as it is almost impossible to separate the piling when pulling.

Probably the most efficient way of driving sheet piling is by means of steam hammers. Frequently a hammer of this type is not available for the work, in which case sheet piling may be driven by a self-propelling track driver, or by a drop hammer which may be rigged up on a scow or on skids. Locomotive cranes are often equipped with leads and are used as drivers.

One of the problems confronting the clean-up of the work is that of pulling steel sheet piling so that it may be used again. Where it is not over 24 ft. in length, a wrecking derrick has been used with good results, but the coffer-dam must be close to the track so that the derrick can reach it. Where distortion has taken place or the sheet piling is of greater length than 24 ft., an "A" frame constructed of good second-hand bridge timbers may be used. In sandy soil a water jet has been used to relieve the pressure against the pile, making the pulling easier. With the advent of the double-acting steam pile hammer a new method has been evolved for pulling the steel piling, for this hammer can be inverted and used in the same manner as when driving. When the hammer is required for inverted service it is furnished with bent channel guides in place of the straight ones used for driving and a specially drilled valve chest supporting casting, so that in the inverted position it receives steam on the up stroke only and drops back of its own weight.

Excavations for Buildings and Sewers

On the deeper excavations for buildings, sewers, etc., there is no question but that every type of labor-saving device possible should be used. Probably the most efficient of these devices is the caterpillar shovel, of either the gas, electric, steam or Diesel type, which can quickly be converted in the field from a shovel to a crane, a drag line, a ditcher, a trencher, a skimmer or a back-filler. There are numerous types on the market and they may be used with team or truck dump wagons and occasionally with air dump cars. They have the advantages of adaptability to almost any type of excavation and of not requiring rails to operate on. Where trackage is available, the locomotive crane with a clam shell or orange-peel bucket on a 50-ft. boom or longer (depending upon the width or length of excavation) has been a very effective tool, as have also the locomotive ditcher and the railroad ditcher, dismounted from its flat car.

Compressed air equipment, such as drills, jackhammers, clay diggers, etc., are very effective and economical in excavating rock, clay, etc., which cannot be handled with pick and shovel, particularly when the excavations are not of any magnitude, as would be the case for oil separators, cinder pits, etc.

Several large sewer and drainage excavations have been made by using railroad ditchers equipped with ¾ yd. drag line buckets of the skeleton type. The usual method is to unload the ditcher from its flat car, spur it out and work it under its own power on sections of track, which it can pick up and move ahead as the work advances. This is particularly advantageous as the ditch may be excavated without moving any unnecessary excavation and the ditcher may be used for handling the pipe before moving ahead. There are also numerous trench-digging machines on the market which may be used to good advantage for this type of trench excavation.

Foundations of Turntables Built Under Traffic

Excavations for turntable foundations involve many special features. When made for the purpose of providing a longer table to handle the increased weight and length of locomotives it is necessary to keep the old table in service and the roundhouse in operation during all the stages of the work.

As a rule the old turntable center must be entirely replaced on account of a difference in height or the insufficient bearing capacity of the old center. In one case on the Southern Pacific where the turntable center was supported on piles, excavation was made around the outside of the old center, down to the foundation bed. Additional piles were driven for the increased base of this center and the concrete poured and tied into the old base with ⅞ in. deformed bars. The old center was drilled horizontally above the new foundation base with a "jackhammer" drill and steel wedges were set for driving. When the old turntable had been lifted up, the wedges were driven in and the center broken from its base, after which it was removed by a locomotive crane. The foundation course was then carefully leveled off with an air-driven chisel and a new cap block set by a locomotive crane on a thin course of rich mortar. It is interesting to note that in one of these turntable replacements, the actual time between the turning of the last engine on the old table and the turning of the first engine on the new table, was only 1 hr. and 31 min.

A longer table makes necessary the construction of a new circle wall outside of the old one and the deepening of the pit itself. In making the excavation for this, the most favorable method is by means of a locomotive crane with a 50 or 60-ft. boom, operating from the old turntable, with dump cars on the radial tracks.

There are certain fundamental principles which may be set down in the interest of economy, as follows:

1. Thorough planning, organizing and supervising of the work. A bridge and building foreman in responsible charge of the actual work, acting under and reporting to his superior officer.

2. The use of labor-saving devices wherever possible, particularly those which will not interfere or be interfered with on account of train operation.

3. The judicious use of work trains, bearing in mind the

J. S. Huntoon is assistant bridge engineer in charge of field operations on the Michigan Central, with which road he has been employed for a number of years. He was elected a director of the association in 1923 and was advanced to vice-president in 1925.

J. S. Huntoon
Third Vice-President

C. S. Heritage has had bridge experience in three district fields, namely, with a bridge company, with a consulting engineer and, for the past 17 years, as bridge engineer of the Kansas City Southern. He was elected a director in 1924 and vice-president in 1926.

C. S. Heritage
Fourth Vice-President

economical handling of the job and the cost and loss of time incidental to their use.

4. The care and maintenance of equipment during the construction period, so as to avoid delays due to break-downs or to equipment being out of repair.

5. The thorough overhauling and repairing of equipment immediately after a job has been completed, so as to have this equipment ready for emergency use or for the next job.

6. Careful watching of the job so as to avoid accidents, which can be accomplished only by the personal supervision and alertness of the foreman and his assistant.

Committee: H. I. Benjamin (S. P.), chairman; R. C. Henderson (B. & O.), vice-chairman; A. Montzheimer (E. J. & E.); J. A. Campbell (N. P.); and J. Mendenhall (O.-W. R. R. & N. Co.).

Discussion

In discussing this report H. A. Gerst (G. N.) urged that precautions be taken to insure an excess amount of cement in the mix (at least seven bags to the cubic yard) when concrete is to be deposited under water, because after the concrete has set and the water has been pumped out one may expect from ⅛ in. to 2 in. of "laitance." A number of members then described the manner in which interesting excavation problems had been solved, these methods being influenced largely by the local conditions prevailing at those points.

Recent Developments in Concrete Practice

OWING to the rapidity with which improvements are being made in the mixing of concrete, a report was presented on Recent Developments in Concrete Construction Practice, from which is abstracted the following material relating particularly to the water-cement ratio and the methods of securing quick hardening concrete.

In order to find out the reasons for such failures as have occurred in the past, the Portland Cement Association and several of our universities have in recent years made a large number of tests of concrete with varying materials, and also with different ways of working. The results of these tests show clearly that there are right ways which produce good concrete and wrong ways which result in poor or bad concrete.

In the past, the instructions for the proportions to be used covered only three of the raw materials, namely, cement, sand and stone, and gave no strict rule for the quantity of the fourth part, viz., water. Tests have shown that the main cause of poor concrete has been an excess of mixing water, and further, that for the same materials and conditions of handling, the strength of the concrete is entirely dependent on the proportion of water to cement used. This proportion is called the water-cement ratio and means the number of gallons of water to be used with one bag of cement.

When the water-cement ratio is given, the amount of water is fixed for dry sand. When stored in the open, sand will usually contain more or less water. The following will give a rough idea of the reductions to be made (based on 2 cu. ft. of sand for each bag of cement).

Damp sand, ½ gal. for each bag of cement.

Fairly wet sand, 1 gal. for each bag of cement.

Very wet sand (right after a rain), 1½ to 2 gal. for each bag of cement.

As the control of the water is the most important part of the concrete proportioning, it will be well to consider what happens to concrete mixed with different amounts of water, first, in regard to early strength and next as to durability and service, and the following table shows the expected breaking strengths of various water-cement ratios at the end of 28 days:

Water,	4¾	gal.	per	bag	of	cement:	Strength	4,1000	lb.	per	sq.	in.
"	5½	"	"	"	"	"	"	3,400	"	"	"	"
"	6¼	"	"	"	"	"	"	2,800	"	"	"	"
"	7	"	"	"	"	"	"	2,300	"	"	"	"
"	8	"	"	"	"	"	"	1,800	"	"	"	"

Concrete made with excess water may not have the strength required for the service intended, and may break up or crack for this reason, but is also likely to give less than the expected life, due to other causes.

There are two different ways of determining the right proportions, the calculation method and the trial method. When the calculation method is used, the sand and stone must be accurately graded and uniform throughout. The laboratory or engineering offices obtain samples, make sieve tests of the fineness of the material, and determine by calculations the proportions of sand and stone to be used. On the larger jobs where an experienced engineer is in attendance at all times, frequent slump tests and sieve tests of the materials used will insure uniformity or permit changes in proportions if changes should occur in the fineness of the sand and stone. Some railroads also use this method on the smaller jobs done by their own forces, furnishing carefully graded sand and stone, and issuing to the concrete foreman tables showing the proper proportions of sand and stone to use from the various pits or quarries for different kinds of work, water contents and slump also being specified.

With the trial method the proportions of sand and gravel are not specified, but are to be determined in the field, sample batches being made until the proper workability is obtained. Where the work is handled by railway forces and the exact proportioning is not given on the basis of laboratory tests the trial method will be the only way for the concrete maker to determine the proper proportions of sand and stone. The experienced man will know from the condition of the batch if it is workable or not and will know how it can be improved if it does not seem just right. The various conditions which are likely to be found and the remedies are given below.

The trial mixture is made with the correct amount of water and with dry sand. If the first batch is too soft or wet, it will, as a rule, need more sand and stone. If it is wet but at the same time harsh (coarse or stony) it probably has enough stone in it already and should have more sand. If it is wet but needs more stone than sand to make it work right, the lack of stone is readily seen as the mass will show excess mortar. It is well to remember that additional sand will dry up the mixture much faster than the addition of stone.

A trial batch which is too dry for working has too much sand or stone in it. To use more water in order to make it workable would be adding insult to injury, but for the purpose of saving the batch, water and cement in equal parts by volume can be added. In the next trial batch, however, the amount (by volume) of sand or stone should be reduced. If the mixture is too harsh (coarse) the amount of stone should be less, and if too sandy (over sanded or seeming to contain too much mortar) the amount of sand should be less. Very often some reductions will have to be made in both sand and stone.

After a few trials the concrete maker will have what he considers a workable mixture and he makes a slump test and proceeds with the work. He will soon find out, as the filling of the forms goes on, whether his judgment was good, in which case his concrete will work well, pack solidly without voids and not bring an excess of water to the top surafce. Such concrete will have a dense finish and show no voids or honeycombining when the forms are taken off.

After the desired mixture has been determined the slump test can be used during the progress of the work, and this is valuable not only as a check on water content and workability, but the experienced concrete maker will soon find out that the concrete from the slump cone is actually a small sample from the batch, spread out before his eyes for inspection.

It may seem at first glance that considerable risk would be involved in leaving the fixing of the proportions of sand and stone to the man in the field. It is apparent, however, from the foregoing that the determining features are entirely of a practical nature, proved by practical results, and that the experienced and conscientious concrete maker is in every way in a better position to judge these than the man in the office, unless the latter has made a thorough scientific investigation of the materials.

When a deep section of concrete is poured continuously the weight of the mass will force mixing water from the lower part of the concrete towards the top. This surface water should either be removed or the following batches mixed drier and thoroughly worked in the forms, so that the excess water can be taken up by the new concrete and the strength kept the same throughout. If water comes to the top of the concrete as a yellowish muck or scum, "laitance" has developed. This is

caused by too much mixing water, fine cement parts not thoroughly mixed into the mortar and often clay or humus in the sand. This laitance will always cause poor concrete and should be removed. Where the strength of the concrete is important, it is better to remove and waste a few inches of concrete below it, as this also is likely to be affected, containing too much water and the concrete, therefore, will be weak and porous.

Curing

The forms must not be taken off until the structure has gained strength enough to support itself safely; reinforced concrete slabs, beams and girders particularly should be carried by the forms until a high strength is developed. Generally, instructions will be issued by the engineer, but the following will give a general idea of usual practice for summer work when the temperature is 60 deg. and over:

Piers and abutments, not less than 2 days.

Light walls and columns, not less than 3 days.

Slabs, beams and girders, not less than 14 days.

For fall and spring, when the temperatures are between 40 deg. and 60 deg., add half the length of the time, and for winter work, even with good frost protection, the time should not be less than twice that given above.

In moderately cold weather the forms will give all the protection required against frost, and in severely cold weather much more extensive protection work will be needed with the forms off. In the summer, the forms will prevent the drying out of the concrete, which will stop the hardening, first on the surface, and later deeper in the concrete.

Quick Hardening Concrete

At times conditions are found where it is important to have the structure in service in a short time, making an increased cost permissible. Concrete of high early strength is usually obtained by one of the three following methods:

(1) Use of ordinary Portland cement with a low water-cement ratio, which will require rich mixtures for workability.

(2) Use of ordinary Portland cement, adding chemicals for speeding up hardening.

(3) Use of special quick-hardening cement.

Bearing in mind that cold weather makes hardening much slower, we present herewith a table published by the Portland Cement Association, showing typical rich mixtures and their gradual increase in strength. This is based on 70 deg. minimum temperature, moist curing and not less than one minute mixing time and the use of the Portland cement without hardeners.

Calcium chloride is the most commonly used chemical for speeding up the hardening of Portland cement concrete. It can be bought commercially from the manufacturers in the form of white flakes, but can also be obtained in the form of a powder said to contain lime and calcium chloride, the contents of the latter being about one-third of that in the commercial product. A liquid is also on the market which contains calcium chloride in solution.

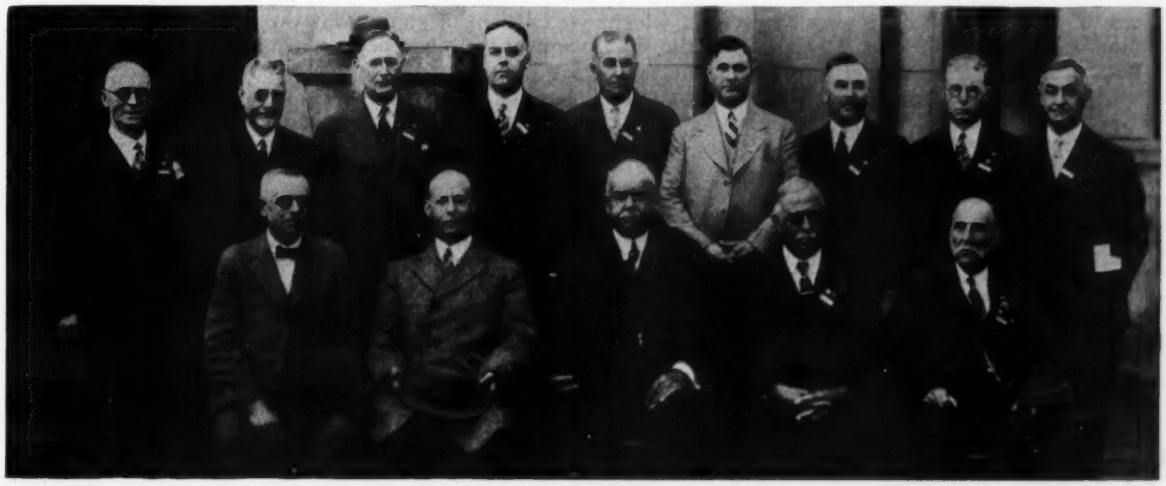
Water-Cement Ratio (gal. per sack)	Compressive Strength in Pounds (cured wet until test) 1 day	3 days	7 days	28 days	Typical Mixers (Illustrating range for a particular set of aggregates) Slump (Ins.)	Mix.	Bbl. Cem. cu. yd
7½	100	500	1,100	2,000	6-7	1:2:3½	1.40
6½	230	830	1,530	2,600	2-4	1:2:3½	1.40
6	300	1,000	1,800	3,000	½	1:2:3½	1.40
6	300	1,000	1,800	3,000	6-7	1:1½:3	1.65
5½	370	1,230	2,070	3,400	2-4	1:1½:3	1.65
5	470	1,500	2,400	3,900	½	1:1½:3	1.65
5	470	1,500	2,400	3,900	6-7	1:1:2	2.25
4½	600	1,800	2,800	4,300	2-4	1:1:2	2.25
4	830	2,130	3,170	3,900	½	1:1:2	2.25

There are some Portland cements on the market which are quick-setting, but in cases where early strength is urgent, use is made most frequently of a high alumina cement. Concrete made with this product is not quick setting; that is, the hardening process does not start immediately after the mixing, and if the proper precautions are taken, the mass will remain workable for ample time to permit its handling from the mixer into the forms and working in them. In 3 to 4 hours, however, the hardening process begins and the mass then gains strength very rapidly, gaining in 24 hours approximately the same breaking strength as Portland cement concrete mixed in the same proportions after 28 days. On account of the rapid hardening, concrete with this cement will develop very much more heat and contraction during the first 24 hours than Portland cement concrete.

At present market prices its cost is approximately three times that of Portland cement, and the cost of the concrete with which it is used is increased from $4 to $8 per cu. yd. It is, therefore, not expected that it can compete successfully with Portland cement for ordinary work, but there are many special conditions where its use will be justified. Where it is urgent to obtain concrete strong enough for service in the shortest possible time, it will be found of particular value. The mixing of alumina cement with Portland cement is not recommended and the manufacturers of both products strongly recommended against mixing them.

Two appendices accompanied the report, appendix A showing methods to be used in making the slump test, and appendix B describing the standard methods of making and storing specimens of concrete in the field.

Committee: A. B. Scowden (B. & O.), chairman; F. H.



Thirteen Past-Presidents Attended the Convention

Front row reading from left to right: C. A. Lichty, inspector, purchasing department, C. & N. W., Chicago, 1905; A. Montzheimer, chief engineer, E. J. & E., Joliet, Ill., 1904; W. A. McGonagle, president, D. M. & N., Duluth, Minn., 1896; J. H. Markley, master bridges and buildings, T. P. & W., Peoria, Ill., 1907; and F. E. Schall, bridge engineer, L. V., Bethlehem, Pa., 1912. Rear row: J. P. Wood, supervisor bridges and buildings, P. M., Saginaw, Mich., 1925; J. S. Robinson, retired division engineer, C. & N. W., Chicago, 1924; F. E. Weise, chief clerk to chief engineer, C. M. & St. P., 1920; Elmer T. Howson, editor, *Railway Engineering and Maintenance*, 1927; S. C. Tanner, superintendent maintenance of way shops, B. & O., Martinsburg, W. Va., 1918; Lee Jutton, contractor, Milwaukee, Wis., 1919; George W. Rear, engineer of bridges, S. P., Pacific System, San Francisco, Cal., 1916; C. R. Knowles, superintendent of water service, I. C., Chicago, 1922; and C. W. Wright, master carpenter, L. I., Jamaica, N. Y., 1926.

Masters (E. J. & E.), vice-chairman; W. T. Krausch (C. B. & Q.); C. S. Heritage (K. C. S.); N. Stadtfeld (Board of Transportation, New York City); and A. C. Irwin (Portland Cement Association).

Discussion

That portion of the committee's report relating to rapid-curing cements first aroused discussion. C. W. Wright (L. I.) inquired why the manufacturers opposed the mixing of quick-hardening cements with standard Portland cement, to which A. C. Irwin (Portland Cement Association) replied that such action changed the characteristics of the cements and produced a "flash" set. E. G. Storck (Reading), E. A. DeWald (A. T. & S. F.), and J. A. Klasner (A. T. & S. F.) referred to their use of alumina cements where rapid curing was desired, Mr. DeWald stating that with this cement he had found it possible to secure the same strength in 24 hours as in 20 days with ordinary cement. Mr. Storck referred to the necessity of keeping concrete in which alumina cement has been used wet during the first 24 hours as it heats rapidly. In discussing the same point, Mr. Klasner stated that he has found that the surface will crack unevenly unless it is kept very wet. Another member stated that on three or four occasions he has found it possible, when using alumina cement for machinery foundations, to pour concrete as late as six o'clock in the evening and begin erecting the machinery at seven o'clock the following morning. H. A. Gerst (G. N.) then described two projects in which similar results were secured by using a 1-1½-2½ mix of standard Portland cement concrete in encasing steel girders in concrete on which live load was transferred in two or three days.

The members also showed much interest in the water-cement ratio and particularly in ways to educate foremen as to its use. A. C. Irwin described the manner in which the Portland Cement Association built its new office building in Chicago with specifications which fixed only the maximum amount of water that should be used, leaving it to the foremen to develop the proportions which would give them good concrete with this single limitation, saying in effect to the foremen, "All I ask of you is that you use six gallons of water with every sack of cement and give me a good job, but if you use more than six gallons of water I'll discharge you." The specifications contained no requirements as to strength because it was recognized that by controlling the water, the desired strength would be secured. W. T. Krausch (C. B. & Q.) stated that the principle of the water-cement ratio had been recognized and applied by the Burlington and described a booklet prepared for the use of foremen in which, in addition to brief practical instructions, there is incorporated a table showing the proportions of the different ingredients for each of seven classes of concrete (for use in piers, beams, girders, etc.) with gravel from each of the authorized pits on that road, these proportions having been determined by a scientific investigation of the characteristics of the different aggregates in the light of the strength required for concrete for the various purposes.

Report on Stockyards Facilities

WHILE NOT included among the major railway structures, stockyards are important facilities on many roads, particularly in the central and western states. Because of the fact that they are commonly neglected, a committee was appointed to consider the problems arising in their design and maintenance, which committee reported in part as follows:

Stockyards vary in size from the chute and one small pen at some obscure siding where only an occasional car is loaded, to the large collecting or holding yards in the range country where trains are loaded daily during the fall movement of range stock to market. Between these two extremes are the ordinary stock yards where one or more cars of stock are loaded almost every day in the year. This type, because of being in continual use, requires frequent inspection and repairs.

Fences are generally built of 2-in. by 8-in., or 2-in. by 10-in. plank, six or seven plank high with spaces between, and securely spiked horizontally to posts spaced 5 ft. 4 in. to 6 ft. centers, and are from 6 to 7 ft. high. Posts are from 10 to 12 ft. long, and should be set 4 ft. in the ground to hold the fence in line. Woven wire fence has been used in an experimental way on the Kansas division of the Union Pacific and on the Wyoming division of the Chicago & North Western. Where these fences have been built they have given good satisfaction and they have required no maintenance since they were installed; however, as they have been in place only about two years, their lasting quality as compared with plank has not yet been determined. In Western states, where range sheep are loaded, woven wire has given good satisfaction and service for sheep loading yards.

Loading chutes for cattle must of necessity be of strong construction, and are generally built with 2-in. plank sides and with a 3-in. plank floor provided with 1-in. by 3-in. cleats spaced 12-in. centers to give stock a foothold. The slope of the floor should not be more than one foot in four, and is generally less.

For double deck cars where loading is done only occasionally a double deck loading apron is provided. These aprons are made of a width to fit into the loading chute, are 12 ft. long and are made of 2-in. plank held together by three 2-in. by 6-in. cleats bolted to the bottom side and 1-in. by 3-in. cleats on 18-in. centers, nailed on the top side for a foothold for stock. At the upper end two strap hooks are provided, made of ½-in. by 2½-in. iron.

Where requirements for loading double deck cars are more frequent in the western territory, as where many sheep are loaded, a double deck chute is provided. The Union Pacific and the Chicago, Burlington & Quincy provide double deck chutes built alongside the standard stock chute, with a sufficiently steeper pitch so that the upper end will be at the same height as the top floor in the car at a point 6 ft. from the top end of the chute. At this point in the wall between the two chutes are a gate and an apron which swings down and across the main stock chute; from this apron a portable apron reaches the upper deck in the car. With this type of double deck chute the upper and lower decks of the car are loaded at the same time.

The Chicago & North Western provides a double deck chute which is built longer than the standard chute, with the top of the floor level with the top of the platform 16 ft. back from the front of the platform. This section of floor forms an apron which is hinged at the break in the chute floor and is raised and lowered with counterweights and cables which pass over sheaves in a frame at the top of the posts. When raised for loading the upper deck a piece of 1¼-in. pipe is passed through the chute to support it. The apron reaching to the car is hinged to the end of this movable section of floor and folds back into the clear when not in use. This type of double deck chute gives very good satisfaction, especially for loading hogs in double decks as, with the floor raised to the upper deck the chute has the same easy slope all the way.

One of the most difficult problems in connection with the maintenance of stock yards is to keep the floor of the pens reasonably dry, and to keep out mud holes which are usually caused by some shipper flooding the yards through carelessly leaving the hydrant open, the hogs doing the rest. When mud holes appear and complaints come in, the first aid usually given is a car of cinders, but this filling lasts only a short time, especially with hogs. To remedy this, some yards have been paved with coarse crushed stone with a gravel or cinder top

finish, which, while expensive, will last. Gravel makes a good paving for a time, but with the annual cleaning out it gradually disappears. Yards have also been paved with old bridge timbers. A cheap and effective job of paving has been done by covering the floor of the pen with old ties closely laid and chinked, and with a covering of dirt or cinders. Unless pens are continually flooded, this type of paving will last a number of years. For ordinary stock yards surface drainage is generally secured by placing the floor of the pens at a higher elevation than the surrounding ground and sloping it towards the outside fences. Tile drains have been used at some of the larger feed and rest yards.

At outlying points where city water or water from locomotive supply tanks is not available small elevated water tanks of either galvanized iron or wood, are provided, with a well and a windmill for furnishing water. Generally these small elevated tanks are not provided with frost boxes to prevent the freezing of pipes, because so little water is used during winter months that the tanks are drained and any water used is pumped direct to the troughs. Pipe lines are usually 1 in. to 1¼ in. in diam., according to the number of hydrants in the yards. Usually about one-half of the pens are provided with hydrants. Hydrants, wherever possible, should be placed outside of pens and opposite partition fences so that one hydrant will serve two pens; they should be provided with hose connections and short sections of hose to reach water troughs. Both the common tee hydrant with riser and the self-closing hydrant are used.

Water troughs are made of wood, metal and concrete. Wood water troughs are made of 2-in. plank, usually 12 in. wide, 10 in. deep, and 12 to 16 ft. long, and are in frequent need of repair and renewal because of leaks caused by shrinking. Metal troughs are made of heavy galvanized iron and can be had in various lengths. Concrete troughs, where used, are made over standard forms at some central point and shipped out as needed. These are very heavy, and have the additional advantage over wood and metal troughs in that they need no fastening as when they are once placed, they are heavy enough to stay put. Floors of yards around water troughs should be higher than the balance of the pen as a help to prevent mud holes.

Sheds are provided in stockyards as local conditions require, usually about one-third of the pens being protected with sheds. For the ordinary stockyards, sheds about 16 ft. by 32 ft. are generally sufficient, since ordinarily only one car of stock is kept in each pen. Sheds are generally built with a fence forming the back side and with the front side open. The roof is of frame construction, supported by posts set in the ground with 2-in. by 8-in. girders spiked to posts, on which are laid 1-in. by 12-in. boards with battens over the cracks. This type of shed serves well where shade only is required. Where better protection is needed the roof is laid tight with 1-in. boards, and then covered with composition roofing. This type of roof is used more commonly in the southern territory where more protection is required from rain, especially in feed and water yards.

Where scales are provided, they are usually of four tons capacity, with 8 ft. by 14 ft. platforms, with suitable racks or frames with gates on each end, and wherever necessary, with connecting fences leading to pens. They are set with either concrete or brick pits, or with a pit and foundation of second-hand timber. As a general practice no part is enclosed except the beam.

Stockyards in general, in order to be kept in good condition, should have frequent inspection, so that necessary light repairs can be reported and made promptly, and the yards kept in such usable condition as to avoid complaints from shippers.

Committee: H. Heiszenbuttel (C. & N. W.) chairman; J. J. Taylor (K. C. S.); E. P. Hawkins (M. P.); A. J. James (A. T. & S. F.); J. H. Stearns (C. R. I. & P.) and G. T. Ray (U. P.).

The C. M. & St. P. Was Well Represented Ready for the Trip Through the Hull-Rust Mine

The Special Train on the Dock at Duluth The C. & N. W. Had 23 Members Present

Discussion

J. H. Markley (T. P. & W.) referred to the fact that while it was possible to buy fencing lumber in years past for $12.50 per 1,000 ft. b.m., its cost has now risen to $65 to $70, as a result of which his road is now building its fences entirely of heavy woven wire fastened to 2 in. by 6 in. timbers, spanning between posts at the ground line and at the top. W. A. Batey (U. P.) stated that his road had

used three different types of 72-in. woven wire with success, but found that it requires 20 per cent more bracing and more care in setting the corner posts and in attaching the wire to the posts than with plank. W. T. Krausch (C. B. & Q.) emphasized the importance of scale inspection and maintenance because of the fact that the shipper depends upon these scale weights in paying for his stock.

H. I. Benjamin (S. P.) opposed the use of old bridge timbers as flooring material in stockyards for the reason that the slime that collects over the pens causes the floor to become slippery and frequently results in claims from broken legs and other damage to stock. Furthermore, the renewal of a floor of this construction is difficult. In its place he favored the use of gravel or crushed rock.

The committee's reference to concrete floors was discussed at length. L. C. Smith (I. H. B.) described an experience with this form of construction at a large feeding yard with a capacity of 300 cars of stock, where it was found to be too slippery and was replaced with paving brick. A. B. Scowden (B. & O.) then described a floor built on his line three years ago on which the concrete was roughened by dragging cables over it in different directions, which eliminated the trouble referred to by Mr. Smith. S. Lincoln (G. C. & S. F.) reported excellent results from the application of an 18-in. layer of shells.

Maintenance of Water Treating Plants

THE STEADILY increasing recognition of the economy of treating locomotive water supplies is adding to the problems of water service forces in maintaining and operating these plants. Realization of this fact led to the appointment of a committee to report on The Maintenance and Operation of Water Treating Plants which, after calling attention to the fact that less than one-third of the water used by locomotives is now given the proper attention, reported in part as follows:

In view of the large sums involved, as well as the effect upon actual transportation and railroad operation, the question of maintaining and operating water treating plants properly should receive most careful attention. An improperly operated water treating plant is not only an economic loss but will also cause serious trouble, due to continued scale formation in the locomotives as well as to promote foaming troubles which result in expensive traffic delays.

Orderliness and cleanliness are of first importance. It may be possible to secure satisfactory results with dirty and ill-kept plants, but the probability is in the other direction. The appearance and general condition of the plant are indicative in a general way of the ability of the operator and of the supervisory forces.

The technical nature of this work necessitates that it must come under the general supervision of men trained in the understanding of the chemical principles involved as well as the mechanical and engineering features. Under this supervision several plans are in effect for detailed inspection, check, and control. To be successful these must be ample to insure proper treatment regularly, which means every day on every shift, rather than of an intermittent character.

One system which appears to show very satisfactory results consists of a centrally located control laboratory to which samples of both the raws and treated water are furnished semi-weekly from each plant. These tests must be followed by field inspection with portable chemical test sets wherever the laboratory tests indicate improper functioning or a possibility of incorrect treatment. At important points, samples are collected on each shift and where water quality is subject to frequent and acute changes, it is sometimes advisable to instruct the operator in making simple tests from which chemical changes can be applied.

Another system of control organization which is in use on many railroads relies largely upon frequent inspection and check by traveling inspectors. This is occasionally supplemented by daily tests made at the plant by the operators but the general plan appears to be to limit the number of plants per inspector so that the results and operation of each plant may be checked every few days by specially trained men. These men are usually chemists but satisfactory results are also secured with inspectors who have had practical experience with plant operation and have shown special aptitude for this class of work.

It is well in either case, that all concerned, particularly the division supervisory officers interested in or responsible for plant operation, be kept posted regarding the test results, at least to the extent of their being satisfactory or otherwise; they should be furnished suggestions or recommendations promptly for correction and improvement.

As a general rule, these plants are designed to fit in with water station facilities already in service and the equipment used is selected to meet the local conditions and it is customary for the operator to handle all light running repairs.

The problems of the storage and handling of chemicals are somewhat similar for all types of plants. In some of the more modern installations, conveyors have been provided at the unloading tracks and chutes to save wheeling from cars to the storage room. Where lime and soda ash are used, it is necessary that they be kept dry to retain their strength, and prevent deterioration. This is especially true in plants using bulk quicklime, where air-tight compartments with refrigerator-type doors are used. High grade chemicals are now generally purchased for this work, based on, or similar to the standard specifications of the American Railway Engineering Association, and any uncertainty in the quality caused by deterioration from improper storage is very apt to affect the treatment results adversely.

With intermittent type plants, care should be exercised by the operator to make sure that the tank gages register with reasonable accuracy. Chemical pumps and agitating equipment should be kept in good working order and operated carefully in accordance with instructions. Definite regulations should be enforced, based on observations of sludge accumulation, for cleaning tanks, to prevent sludge getting out to locomotives. Observation should be made occasionally by the operator to insure that all valves are tight and that no leakage exists between the raw and treated water sides of the plant that will stir up milky water and cause foaming complaints.

The continuous plants in use throughout the country vary in design to such an extent that a general discussion only is possible. Detailed instructions covering the operation of the individual stations are usually given to, or posted for each plant, and these rules should be adhered to. The chemical charges are based upon the addition of a definite number of pounds of lime and soda ash to each thousand gallons of water. In most types of such plants it is first necessary to calibrate the equipment in order to obtain the ratio of the chemical solution, to the flow of water. This should be a matter of record and any fluctuation corrected promptly, or reported to the chemist, in order that the chemical formulae may be adjusted accordingly. Reliable ground-operated proportioning devices are now available and are being installed on most new installations; there are also many old style top-operated plants in service, which give regular and efficient results. Where excelsior filters are used, they should be watched and renewed before they become clogged to the extent of starting short circuit currents in the sedimentation tank. The accumulation of sludge on filter beds should be prevented by back-washing and flushing with a hose when necessary, carefully following the instructions of the manufacturers and the incrustation of sand grains should be noted so that renewal may be made before impaired efficiency affects results. The upward flow of water in the sedimentation tank should be kept as slow as consistent with consumption requirements, in order to assist clarification, and if the capacity of the plant is overtaxed to such an extent that the vertical velocity exceeds eight feet per hour, consideration should be given to the use of a coagulant, such as sodium aluminate, applied with the lime and soda ash to improve the chemical reactions and settling conditions. Instructions based on observation and experience are usually posted, showing the extent and time for sludge removal. Occasional short openings at reasonable intervals appear to give better results than heavy drafts at long intervals with a resultant saving in water. Where either automatic or hand-controlled electric equipment is used, it is ordinarily best to have

repairs, adjustments and inspection made by qualified electricians and reports made accordingly.

The proper maintenance of water-softening plants is of particular concern. Regular and consistent treatment is necessary to secure the desired effect in locomotive or steam plant use. A few days shut down of the treating equipment may frequently offset or discredit many months of good results. The most satisfactory method appears to lie in a check of the facilities and equipment frequently enough to insure regular and uninterrupted service.

It is impossible for the supervisor on a busy division to give his individual attention to the many details required in proper treating plant maintenance. As a general rule the operator is held directly responsible for minor repairs which can be handled conveniently in connection with his other duties. It has been found to be the best practice to hold the road mechanic or division repairman responsible for all running repairs of a mechanical nature, as well as for a detailed check to insure proper attention and care by the operator. On some railroads, satisfactory results have been secured by assigning definite districts to these road mechanics of such size and importance that a check of conditions may be made at least every few days at each water station, to enable the necessary attention to be given, and incipient trouble corrected before an actual break-down occurs.

By the assignment of definite responsibility and with a clear understanding of what each man is supposed to do, the improvement in maintenance conditions at water treating plants will fully equally the good records which have been made in keeping up other water station equipment.

Committee: C. E. Brightwell, (C. & O.) chairman; H. H. Richardson, (M. P.) vice-chairman; L. A. Cowsert (B. & O.); B. R. Kulp (C. & N. W.); O. C. Anderson (S. P.); L. C. Prunty (U. P.); F. M Case (C. & N. W.) and C. R. Knowles (I. C.).

Discussion

The discussion of this report was confined largely to the problem of disposing of the sludge from treating plants. R. E. Coughlan (C. & N. W.) stated that this sludge, which when dried is 90 to 95 per cent carbonate of lime, is an excellent tonic for foul land and that a number of universities are experimenting with it as a fertilizer. A. B. Scowden (B. & O.) stated that in the design of water treating plants on his road consideration is given to the disposal of the sludge by (1) turning it into a stream, (2) collecting it in a permanent sedimentation basin with a capacity sufficient to provide for 10 or 15 years' deposit, or (3) collecting it in a temporary sedimentation basin (a ravine or open ground), large enough to take care of the sludge for six months or a year, when it is loaded by locomotive crane and disposed of along the line. J. R. W. Davis (G. N.) reported that it is the practice of the Great Northern to dispose of sludge in streams wherever possible and in the event that this is impractical to collect it in a basin from which it is removed by a crane. E. P. Farrell (M. P.) said that the problem varies with each treating plant and cited one instance where it is possible to deposit the sludge in a drainage ditch where it is washed out in the spring freshets. At most points on his road, however, the sludge is collected in a pit from which it is removed at regular intervals. L. M. Bates (C. & N. W.) stated that he has enlisted the co-operation of authorities of a local farm bureau and chamber of commerce in utilizing this material on sour land in the vicinity and that several experimental installations were already in progress. C. R. Knowles (I. C.) concluded the discussion of this subject with the statement that while

The Canadian National Was Ably Represented
Four Steel Corporation Roads Were Represented: F. C. Baluss, D. M. & N.; J. S. Ekey, B. & L. E.; F. H. Masters, E. J. & E. and W. A. Clark, D. & I. R.

The Illinois Central Delegation
The Supply Men Enjoyed the Trip Through the Hull-Rust Mine

it is generally conceded by the farmer, the treating plant operator and the agricultural colleges that sludge is a good fertilizer, the principal objection to its use is the difficulty of handling it.

R. C. Bardwell (C. & O.) called special attention to that portion of the report emphasizing the necessity of keeping water treating plants clean, stating that "if a water treating plant is kept neat, is well painted and looks well, the chances are that the results from that plant will be equally as satisfactory as the appearance of the plant itself. It has been our experience on the Chesapeake & Ohio that a few dollars spent in paint will be returned many fold in improved service and operating conditions." L. C. Prunty (U. P.) emphasized the fact that if it is worth while to install a water treating plant, it is equally important to operate it at 100 per cent efficiency to secure the benefit from the expenditure.

Methods of Waterproofing Concrete Structures

IN ITS investigation of methods of applying and repairing waterproofing on concrete structures, the committee canvassed the larger roads to ascertain their practices and of 45 replies received, 16 indicated that those roads had no concrete structures so protected or that the use of waterproofing was so limited that they had no information to offer. The committee, therefore, confined its report to the consideration of the practices of the remaining roads. In this study it excluded the study of integral methods, special measures to produce dense concrete and waterproofing paints, although it considered the latter satisfactory for damp-proofing purposes until the concrete cracks and permits water to enter the structure. After reviewing the practices of a number of roads the committee presented the following conclusions:

It is evident, from information received as to the methods used on various roads in different parts of the country, that the trend of the practice is to follow the A. R. E. A. specifications for waterproofing and that the membrane method is the most practical. Material furnished under the existing specifications will no doubt be satisfactory and should give service with proper application. Good material and poor application may not give as good results as inferior material with correct application. Included with workmanship or application is the question of flashing. It is just as necessary to flash waterproofing properly as it is to flash around chimneys and other projections through the roof.

The Causes of Failures and Means of Correction

Failures are due to the following causes:

(1) Holes made in fabric during application.

(2) Waterproofing covering not being self-healing, leading to cracks from expansion, vibration or deflection, allowing water to enter.

(3) Insufficient provision at the points where the waterproofing covering begins and ends.

(4) Lack of proper protective coats over the waterproofing covering.

(5) Settlement of abutments, which open up the waterproofing above the cross-girders.

(6) Waterproofing extending above the ballast line and exposed to sun and frost, causing the exposed portions to slump.

(7) Cracking or rupture of waterproofing by vibration under moving loads.

(8) "Bridges" formed in laying the waterproofing by failure of the membrane to conform to irregularities of the surface.

(9) Rending of the waterproofing course, caused by the movement of the concrete floor mass in expansion and contraction or in settling.

(10) Poor or improper design of structure.

(11) Poor material.

(12) Poor workmanship.

(14) Breaking due to bond between surface of structure and membrane. Shrinkage coupled with expansion and contraction of the structure, especially alongside of girders.

(15) Placing waterproofing in freezing weather and against damp or frozen surfaces.

(16) Top of slab not finished to true grade or smoothed, making pockets for gravel to work into.

Suggestions for correcting the above conditions are as follows:

(1) Replacement of mastic or concrete coverings with liquid asphalt, covered with fine gravel.

(2) Cleaning and dressing mastic covering and placing concrete protective coats.

(3) Complete renewal of older types of waterproofing, using membrane waterproofing and concrete protective coats.

(4) Special protection along ballast stops and walk plates to insure tight joints where concrete and steel join.

(5) Provide natural asphalt with the following characteristics: high melting point, physical and chemical stability; maximum ductility; extreme penetration as shown by low penetration; minimum susceptibility to temperature changes between 0 deg. and 100 deg. F. and minimum loss of inherent qualities through heating. Of the four membranes, wool felt, asbestos felt, burlap and cotton cloth, where permanent satisfaction is desired, the felts are eliminated because of their stiffness and inability to work into or over corners and conform to irregular sufaces, lack of elasticity and inability to take up without fracture any movement in the concrete base. Burlap, being a vegetable fibre, is highly hygroscopic, but has the advantage over felts of greater tensile strength and flexibility. Cotton cloth is the only membrane not open to the above objections but it will eventually be rotted by water unless properly protected which should consist of complete saturation and not merely a coating of the fibres with asphalt.

(6) Provide additional drainage, such as tile on top of concrete protection to hasten run-off.

(7) Provide sufficient slope. This is often dependent on the permissible depth of floor, but should be at least 1 in. in 8 or 9 ft., where possible.

(8) Cut the damaged portion back until all loose or damaged parts have been removed. Then dry the concrete thoroughly and apply a coat of hot waterproofing about ¼ in. thick. After being satisfied that it is bonded to the concrete, the balance can be applied in the usual way until the required thickness is obtained. By using a welding torch all the way around the patch a satisfactory bond between the old and new waterproofing can be obtained.

(9) On highway bridges, waterproofing by membrane can be omitted but cared for indirectly by the use of a 2-in. to 2½-in. asphalt pavement directly on the slabs.

(10) Repairing leaks in concrete walls by the use of Portland cement and caustic soda. Leaks in walls of concrete foundations and in concrete floors of buildings which were not waterproofed at the time of the original construction, or where waterproofing did not prove entirely effective, have been successfully stopped by the following method: A section of concrete around each leak should be cut out to a depth of two inches and the roughened surface thoroughly cleaned. A solution of one part caustic soda to 20 parts boiling water with enough cement added to make a stiff paste, should be rapidly kneaded with the hands, using rubber gloves for protection, made into a ball, pressed into opening and held for two minutes or more; this operation should be repeated until the opening is closed. Water should not be allowed to collect in the opening, but kept brushed out during the above operation. There should be placed over this patch a ¾-in. mortar facing, composed of 1 part cement to 2 parts fine sand, mixed with water in which 1 part paste to 18 parts water had been thoroughly mixed. This facing should be kept moist for two days. Leaks repaired under pressure in the above manner have proven as successful as those not under pressure when sealed.

One of the great troubles in the maintenance of concrete structures is the fact that when a leak is first noticed repairs are not made at once. As a usual thing, these conditions are allowed to run for several years until they become so bad that repairs are imperative. We recommend that investigations and repairs be made as soon as trouble appears. It is most difficult to determine where water gets under the waterproofing coat. Usually it travels a long way before

any sign of it is visible on the under or inside of the structure, and in these cases, we recommend that an examination be made first of the flashing as in probably 75 per cent of the cases that is where the trouble begins. Waterproofing as a rule costs about one per cent of the total cost of the structure and inasmuch as the life of the structure and incidentally the cost of maintenance depend on keeping water away from the concrete, it would seem that one could afford to spend more money to obtain a perfect job of waterproofing.

The design of split slabs on the Chicago, Milwaukee & St. Paul, which are precast and set in place with a derrick, calls for the construction of a small longitudinal ridge or parapet under the center of the track, over which it is necessary to lay the waterproofing. It might be better to reduce the height of this ridge and make sure that there are no sharp corners to cut the membrane. By the addition of a lead plate leaks were taken care of in the Spokane, Wash., station.

Committee: T. H. Strate (C. M. & St. P.), chairman; T. W. Pinard (Penna.), vice-chairman; W. B. Hotson (E. J. & E.); L. B. Alexander (M. C.); S. T. Corey (C. R. I. & P.); A. E. Bechtelheimer (C. & N. W.); Pusey Jones (B. & M.); and W. L. Smith.

Discussion

J. S. Huntoon (M. C.) asked whether any member had ever successfully waterproofed around the gussets of a through or half-through bridge, F. E. Schall (L. V.) replying that he has done this by leaving a little opening around the gusset plates which is filled with cement. A. B. Scowden (B. & O.) reported difficulty on the sloping surface of the waterproofing on the ends of through plate girder spans and stated that he had been using putty or similar materials which tended to crack off after a time. He also stated that when he began to find evidence of leakage a few years ago, he sprayed paint over the cracks adjacent to the girders and arrested these leaks for a year or more. As a result of this experience, it is now his practice when leaks develop to give attention first to the areas next to the girders and gussets and if the leaks continue to renew the waterproofing up this side of the girders. E. C. Neville (C. N. R.) reported that he had used coal tar and asbestos fibre to overcome leaks around girders and gusset plates where overhead sidewalks shrunk away from the girders. In replying to a question, C. W. Wright (L. I.) stated that he had seldom found it necessary to remove the entire fabric when repairing waterproofing for the deterioration and trouble are usually local. Repairing waterproofing is, in his opinion, a highly specialized task as a result of which it is the practice of his company to contract repair work of this character to a company specializing in that work.

The More Uniform Distribution of Work

IN RECOGNITION of the interest that maintenance of way officers are taking in the stabilization of their forces, a committee was appointed to consider the extent to which it is possible to rearrange bridge and building work to provide for more continuous employment through the year and thereby reduce the labor turnover. This commitee reported in part as follows:

The efficiency of the operation and organization of a railroad is judged by its accounts; and in reference particularly to bridge and building work, through the Interstate Commerce Commission's primary accounts, reflecting the major and minor structures expense. The cost of labor forms approximately 30 to 40 per cent of this expense, material costs constituting the remainder. The intelligent and economical distribution of these two expenditures form the basis upon which a successful maintenance organization is built, and it is generally conceded that a uniform distribution of bridge and building work throughout the year offers a partial solution.

This distribution is usually accomplished through the medium of a program of one nature or another. There appears to be an almost universal appreciation of the serious effect that intermittent employment has on the organization and efficiency in maintaining the railways of the country and this can be corrected or at least minimized by working out a more scientific method of arranging our maintenance work whereby large armies of workers will not be idle during a very considerable part of the year. The total annual man hours remain about the same, but due to the fact that they are not scientifically arranged, many excess workers are lost to the railroads or remain on furlough, creating an economic condition that is injurious to all concerned.

The foundation upon which to build a program warrants careful consideration. The management must adopt a definite policy covering such items as the replacement of culverts by pipes, the reconstruction of wooden trestles, the closing of openings in the track, the periodic overhauling of buildings and the regular painting of bridges and structures, before a program can be prepared.

A place should be made for engineers and men with technical training in the bridge and building maintenance organization. Experience has shown that engineers trained in

Waiting for the Special at the Ore Crushing Plant Near Hibbing Much Interest Was Taken in the Duluth Ore Docks

maintenance work are essential to an efficient organization. The systematic training of young engineers for maintenance work should be carefully undertaken, and if in due course they do not display the necessary qualifications to combine practical and technical training with ability to organize, train and supervise work, they should not be retained. This training can best be accomplished by rotation in service, inasmuch as it is essential that they familiarize themselves with the rules and practices of the operating and accounting departments, thus qualifying themselves to prepare an intelligent, workable program adaptable to the bridge and building organization in which they are employed.

The success of a program is contingent upon the ability of the organization to carry it out. If once adopted it must not be deviated from, and yet it must contain a certain amount of flexibility, as experience has shown that extra work such as unlooked-for appropriation work, repairs to buildings and structures due to accidents, etc., tends to distort it at times.

Some roads program only bridge and culvert work, other roads program the painting of bridges and structures as well, while still other roads have undertaken to program the entire season's work with the forces at their disposal. In 1923 this association went on record as favoring the practicability of a uniform painting program for the entire year.

The success of the program does not rest altogether with the men in the field but the supervisory officers are also in a large measure responsible.

The failure of the program method of carrying on bridge and building work is usually found in the details of the program. The program must be intelligently prepared and the material must be ordered sufficiently in advance to insure delivery on the site in keeping with the program. The various program labor items must be followed closely to insure the work being completed on time and this routine necessitates supervision of the highest caliber.

Advantages of a Uniform Force

Bridge and building work is not as seasonal as we are inclined to believe. The disadvantages of winter work are minor. Cold weather may retard construction progress, and on very cold days men cannot work efficiently outdoors. These features may add somewhat to the cost, but with experienced labor engaged in the work this increased cost is compensated for by the quality of the work. Again, winter temperatures are not severe; the severe weather usually extends over but two to three weeks.

An even distribution of bridge and building work over the year has several decided advantages. An item of bridge and building repairs that affects the movement of trains can find its position in the program so that its completion can be undertaken during the light traffic season.

Manufacturers of railway supplies report that their facilities are seldom seriously taxed to capacity, and that the hand-to-mouth policy of purchasing is largely responsible for wide price fluctuations.

The year-around use of equipment is a matter that also warrants attention. In programming bridge and building work consideration must be given to the equipment available so that it can be kept working as continuously as possible, thus rendering the maximum return on its investment. Furthermore, the year-around use of equipment will often reduce the total amount of equipment necessary and may postpone or avoid the purchase of additional equipment.

The year-around employment of labor in a bridge and building organization has many decided advantages. A satisfied workman is usually a good workman. An organization with a small labor turnover presents an organization that is flexible, and forms the nucleus for the larger organization occasionally necessary for extraordinary work.

To compile and record the progress of the program, more or less elaborate records are required to form an accurate comparison of the performance of the vaious gangs. Uniformity in the reports submitted by the foremen is necessary. All forms should be as simple as possible. To secure the proper results, detailed instructions governing the distribution and reporting of the time and material charges are required.

A system of planning and dispatching is needed to outline the order of the work and to assign it to the gangs to follow in sequence, in order to reduce the loss of time consumed by the unnecessary movement of the gangs from place to place.

To develop the efficiency of each gang and to create more efficient supervision, the man hours distributed to each program item should be divided by the actual hours required to complete the item, and thus establish the per cent efficiency.

Conclusions

From the foregoing, your committee has reached the following conclusions on the more uniform distribution of bridge and building work:

(1) A bridge and building work program is essential in promoting a uniform distribution of bridge and building work.

(2) A definite basis upon which to build the program is imperative.

(3) A program on either a large or a small scale is feasible.

(4) The economies to be derived from a program are large.

(5) The advantages enumerated in the body of the report are such as to make a more uniform distribution of bridge and building work highly desirable.

Therefore, the committee urges that the American Railway Bridge and Building Association recommend the adoption of a program whereby a uniform distribution of bridge and building work throughout the year can be effected.

Committee: F. P. Gutelius, Jr., chairman (D. & H.); K. Peabody, vice-chairman (N. Y. C.); W. A. Clark (D. & I. R.); Neal Gregory (C. M. & St. P.); A. I. Gauthier (B. & M.); L. C. Smith (I. H. B.); H. B. Stuart (C. N. R.) and F. O. Condon (C. N. R.)

Discussion

F. C. Baluss (D. M. & N.) opened the discussion of this report with the statement that it is a practice of his road to attempt to maintain forces uniformly throughout the year. In painting, the men are employed on outside work as late in the fall as possible and are then diverted to interior work during the winter. Culvert construction and work of that character is also installed in the winter. E. L. Sinclair (C. M. & St. P.) emphasized the importance of a program if forces are to be employed constantly. On his road, it is a practice to prepare such a program after the completion of the fall inspection, showing each job to be done during the following year, the number of man hours it will require and the date on which the work should be done. In preparing this program, consideration is given to those tasks which can be done during the winter and they are scheduled to be handled at that season. This work includes the renewals of bridge floors, the changing of stringers and caps, etc. In his territory (central Iowa) many jobs can be done equally well in the winter. A. B. Scowden (B. & O.) expressed the opinion that there is little except outside painting, roof work and repairs to walls of buildings that cannot be done during the winter time, while certain work, such as repairs to steel bridges, can be done better during this season when air equipment is available which is required for other operations in the summer. C. E. Donaldson (C. V.) advocated the employment of bridge gangs throughout the winter, stating that it is possible to do much work on timber bridges at that season, thereby releasing the men for excavation and other distinctly seasonal work in the summer. William Shively (C. R. R. of N. J.) also advocated the all year around employment of bridge forces, stating that, in addition to the large amount of dock work which is done during the winter on his lines, permanent employment enables them to retain a better class of men for summer work. T. E. O'Brien (D. & H.) stated that his road had been programming its work since 1919 and that it now finds that there is more work to be done during the

winter than can be completed. The renewal of bridge ties, the placing of concrete and other repairs to timber bridges, the renewal of shop floors and the making of repairs to stations are typical of the work that is done at this season. As a result of this practice this road has not laid off a man in four years. C. D. Turley (I. C.) called attention to the fact that, for a program to be successful, it must receive the support of the officers at the head of the department, as well as of those out on the line.

In the discussion of this report, E. Mills (G. N.) advocated confining men to certain classes of work, believing that this specialization promotes efficiency. T. B. Turnbull (A. A.), A. I. Gauthier (B. & M.), E. H. Brown (N. P.), cited numerous instances in support of this contention.

The Protection of Men Working Under Traffic

FOR THE LAST three years the association has placed a safety topic on its program to keep this subject constantly before its members. This year a committee was assigned to study The Protection of Men Doing Work Under Traffic. In addition, F. C. Baluss, engineer of bridge and buildings, Duluth, Missabe & Northern, presented a paper in which he brought up-to-date an analysis of the accidents among bridge and building employees, presented originally at the 1925 convention. This report and paper are abstracted below:

Men doing work under traffic will get as much protection as the management demands or the men take. If the management insists that in all cases of doubt or uncertainty, the safe course must be taken, ample protection will be within reach; and if the men will at all times look after and be responsible for their own safety they will see that ample protection is provided. The supervisory officer has the responsibility of seeing that all concerned understand and obey the rules.

A man should be required to pass a written examination on the rules and instructions covering the work of foremen before he is promoted to a foremanship or as soon thereafter as possible, which examination should be made a part of such foreman's personal record. Periodical oral or written examinations should also be held to determine whether or not the foremen are keeping themselves up to date. These examinations should not only cover the rules and regulations governing the maintenance of way department but also those rules and instructions of the transportation department that affect a foreman's work.

Work to be done properly under traffic must be very carefully planned. Generally, climatic conditions will be the ruling factor in scheduling bridge and building work, but on some roads traffic conditions outrate seasons in setting the schedule for the bridge and building program. Wherever possible, work under traffic should be scheduled to be done when the traffic is the lightest and then, of course, the problem of protecting men doing the work is partially solved.

Contiguous to cities there are often periods during the night when there are few or no trains scheduled. Good lighting systems are now available, making it possible to furnish proper illumination for almost any character of work. It will be found expedient, economical and safe to fit the work to train schedules although to do so will throw the working hours into the night. Often tunnel work which has to be done under artificial light, is done during daylight hours when train schedules are entirely unfavorable.

Renewal and maintenance work around highway and street crossings or any structure or facility not heavily used at night can best be scheduled when such facilities are being used little or not at all.

Practices

Most work has to be done under more or less traffic and the following practices have been found economical, expedient and safe on various roads.

The practice on some roads is to issue train orders directing trains to approach under control locations where men are doing work that may not allow them to clear trains readily. When work at one location is to extend over a considerable period such orders are covered by general instructions or notices.

One road protects men doing work in tunnels where clearances are close and ventilation poor as follows: Flagmen are sent out in accordance with Rule 99. At each end of the tunnel telephones are installed with watchmen in attendance and station operators on each side of the tunnel keep the watchmen posted as to the approach of trains. Electric signals are installed where men are working in the tunnel and these signals are operated by one of the watchmen to warn men to clear for trains. When all men are out of the tunnel, trains are permitted to proceed.

On one trunk line where train schedules are frequent and important on account of connections, the following practice was adopted to protect men making an extensive bridge renewal under traffic. Train orders and general orders were put out covering operations; a manual controlled block was established for the working area with home and approach signals under the control of the operators at each end of the block: one operator was on the train despatcher's circuit and had telephone connection with the other block office; signals were interlocked so that improper signals could not be given to approaching trains; one responsible man saw to it that all men were in the clear and the track safe and unobstructed before trains were given the proceed signals; care was exercised to avoid delays to trains. Such a system is expensive to install and operate but is justified under heavy traffic.

On all roads the rules call for the protection of traffic from obstructions by flagging and it is to be assumed that men do-

Dave (Hultgren), John (Nelson) and Billie (Lawrence) Were Very Much in Evidence

W. A. McGonagle Showed C. R. Knowles Points of Interest on the Iron Range

The West (George Rear, S. P.) Meets the East (A. I. Gauthier, B. & M.) at the Convention

ing work in locations that will not allow them to clear approaching trains safely and quickly will be given flag protection for other than regular trains, or trains of which they have previous advice.

In obscure locations, such as on sharp curves, in tunnels, cuts or alongside buildings or in any place where approaching trains cannot be seen for some distance, the prevailing practices are to station a lookout or lookouts to warn the men of approaching trains.

Summary

1. The men and their managements should insist that men doing work under traffic be protected.
2. Supervisory officers should know by trial and examinations that foremen are safe and capable.
3. Work should be so programmed and scheduled that it will be done under as light traffic as possible.
4. Avoid working close to high tension electrical lines carrying power.
5. Use flag protection where necessary.
6. Resort to train orders or general orders where protection can be afforded in this manner.
7. Where the work justifies it, install operators or watchmen with communicative signal system.
8. On very important lines protect men and traffic with block systems.
9. Use lookouts where needed.

Committee: G. S. Crites (B. & O.), chairman; G. A. Rodman (N. Y., N. H. & H.); vice-chairman; C. Gradt (C. M. & St. P.); T. B. Turnbull (A. A.); J. A. S. Redfield (C. & N. W.); H. J. Barkley (I. C.); J. E. Buckley (B. & M.); and A. V. Rohweder (D. M. & N.).

Progress of Safety in Bridge and Building Work

By F. C. Baluss

The American Railway Bridge and Building Association took up the matter of accident prevention in 1923 and at the 1925 convention in Buffalo, a report was presented on the reduction of accidents to employees. Four years have now elapsed and it seems pertinent at this time to examine the record and see what has been accomplished.

The number of employees per employee injured in all classes of work shows a gratifying increase since 1923, but on the other hand, there is a slight decrease in the number of employees per employee killed since 1924. The curve representing the latter, however, indicates a consistent improvement over a period of 37 years. Table II, of the 1925 report, concerned bridge and building men only and a slight reduction is noted in accidents to this class of employees. Tables IV and V are obtained from a study of the figures compiled from accident reports of the I. C. C. and are intended to determine graphically those classes of employment which are principally responsible for the fatality and casualty rates in bridge and building work. These tables also take account of the proposal made by the Safety Section of the American Railway Association, at its 1923 convention at Salt Lake City, for a 35 per cent reduction in accidents by 1930. The 35 per cent reduction curve is the heavy line, appropriately designated, with the uniform rate of descent.

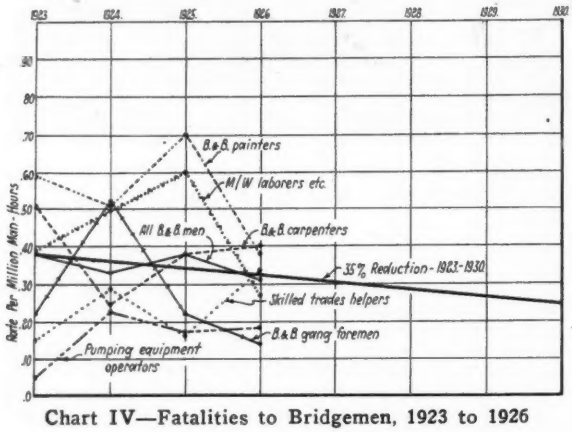


Chart IV—Fatalities to Bridgemen, 1923 to 1926

Other curves are shown for various classes of employment, those selected having the larger totals of man-hours. Bridge and building painters, and maintenance of way laborers are responsible for the higher rates of fatalities while the laborers and carpenters run up the higher rates in casualties. An attempt has been made to determine the causes of the high rates, but unfortunately, the Interstate Commerce Commission, the principal source of railroad accident statistics, does not require this information of the railroads in non-train accidents. Information should be gathered and a study made by the supervisors of safety and the causes of the high rates learned, so that appropriate corrective measures can be applied. If such study is made it will probably be found that falls of persons and objects are two large sources of the higher casualty rates. The subject of ladders and scaffolds was very fully discussed in the 1925 report. It would be well for supervisory men in bridge and building work to analyze the accidents which come under their immediate notice and for which they are, in a way, responsible.

The use of motor cars is increasing rapidly and is found to be the cause of a large number of fatalities and casualties. Few of the railroads require motor cars to be operated under train orders and it is a question if such operation would prove successful, since the character of the work done by men using motor cars is such that the use of train orders would be almost an impossibility. Dispatchers and station operators should be required to furnish motor car drivers with the latest information regarding train movements but with the distinct understanding that such information does not constitute a running right on the track. Supervisory men are vitally concerned in keeping this economical transportation for their crews and should not allow the matter to get out of bounds.

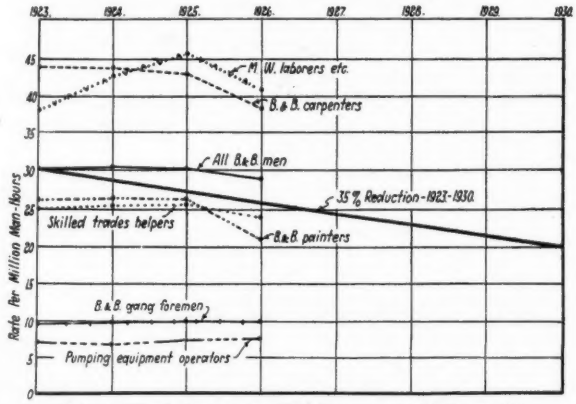


Chart V—Injuries to Bridgemen, 1923 to 1926

A further reference to Chart IV of the curve representing all bridge and building men discloses that, by the end of 1926, a lower rate of fatalities had been made than the proposed rate of 35 per cent reduction by 1930. However, as casualties or injuries not resulting in death, appear to average 80 or 90 times more numerous than injuries resulting in death, a study of Chart V is not so reassuring for the rate of injuries per million man-hours remained almost constant for the years 1924 and 1925 and by the end of 1926 it was more nearly paralleling the 35 per cent reduction curve, but considerably higher.

These tables and deductions outlined here are commended for earnest study in order that bridge and building men may get in line with other railroad occupations where better accident reduction rates are being made.

Discussion

In opening the discussion of this subject C. Ettinger (I. C.) spoke with particular reference to the high accident rate among bridge and building painters. Attributing this record in large part to the large turnover in men, he stated that it had been his experience that the accident rate is highest among new employees. J. P. Wood (P. M.) supported Mr. Ettinger's contention and emphasized the necessity of supervisory officers giving special attention to new employees until they have become accustomed to their duties. J. S. Robinson (C. & N. W.) and C. R. Knowles (I. C.) took exception to this position, stating that it has been their observation that it is the

older and more experienced men who take chances.

T. Turnbull (A. A.) emphasized the necessity of supervisory officers assuming responsibility for the safety of their men. To promote safe practices his road put up a silver cup last year to be awarded to the department that showed the greatest improvement in its accident record and stated that while this cup was won by the maintenance of way department, the poor record made by the bridge and building department nearly lost it. This cup was awarded on the basis of reportable injuries and Mr. Turnbull stated that he was considering the awarding of a similar prize to the bridge and building gang that made the best record on the basis of a graduated scale of demerits for accidents of all kinds. J. P. Wood (P. M.) advocated equipping every bridge gang with a portable telephone to enable it to keep in touch with train movements and thereby avoid accidents from this cause as well as delays to traffic. C. Ettinger (I. C.) described the practice in effect on that road of selecting men from the gangs to attend safety meetings, which practice has been found to appeal to the pride of these men and cause them to become ardent advocates of safety on their return to their gangs.

W. A. Batey (U. P.) stated that the enviable record of his road in accident prevention is due in no small part to supervision. Among other measures that are in vogue, foremen and higher supervisory officers are required to attend safety meetings; two or three of the older men in every gang are examined on the rules and are subject to call for the direction of work at any time when the foreman is absent or the gang divided. Every accident, even though it results only in a nonreportable injury, is subjected to investigation on the theory that it didn't "just happen," employees are constantly warned against taking chances; supervisors and division engineers confer with the foremen regarding detailed methods of handling every job assigned to them, including the manner of erection and use of scaffolding where necessary and foremen are held responsible for the safety of their men at all times and are disciplined for negligence. J. M. Cowsert (M. P.) added that the investigation of accidents on his road has shown that the secret of safety lies in reminding the men every morning that there must not be any accidents that day, rather than in disciplining them after an accident occurs.

Manufacturers Present Exhibit

SIXTY-SIX firms, engaged in the manufacture of materials and equipment used in the construction of bridge, building and water service facilities, presented an exhibit of their products adjacent to the convention hall, this number of exhibitors exceeding that in any previous year. Exhibits were also arranged in a more attractive manner and were more practical in character by reason of the fact that many companies presented full-size equipment. The exhibit, for this reason, attracted more than the usual amount of interest.

The officers of this association during the past year were as follows: President, John E. Nelson, Joseph E. Nelson & Sons, Chicago; vice-president, B. J. Wilson, The Pocket List of Railroad Officials, Chicago; treasurer F. M. Condit, Fairbanks Morse & Co., Chicago; secretary, D. A. Hultgren, Massey Concrete Products Corporation, Chicago; honorary director, Dan J. Higgins, American Valve & Meter Co., Chicago; members of executive committee: O. T. Snow, T. W. Snow Construction Company, Chicago; W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; R. F. Repasz, William Robertson Company, Inc., Chicago; D. A. Evans, Kaustine Company, Inc., Perry, N. Y.; G. C. Mills, Zitterell-Mills Company, Webster City Iowa; and P. C. Jacobs, Johns-Manville Corp., Chicago.

At the conclusion of the exhibit, the following officers were elected to serve for the ensuing year: President, B. J. Wilson, The Pocket List of Railroad Officials, Chicago; vice-president, F. M. Condit, Fairbanks Morse & Co., Chicago; treasurer, D. A. Hultgren, Massey Concrete Products Corporation, Chicago; secretary, W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; honorary director, John E. Nelson, Joseph E. Nelson & Sons, Chicago; members of the executive committee: R. F. Repasz, William Robertson Co., Inc., Chicago; D. A. Evans, Kaustine Company, Inc., Perry, N. Y.; G. C. Mills, Zitterell-Mills Company Webster, City, Iowa; P. C. Jacobs, Chicago; W. D. Bennett, Dearborn Chemical Company, Chicago; and J. M. Rutherford, *Railway Engineering and Maintenance*, Chicago.

The companies exhibiting, together with the nature of their exhibits and the names of their representatives, follow:

List of Exhibitors

American Hoist & Derrick Company, St. Paul, Minn.; literature and photographs of locomotive pile drivers, three-speed gasoline crane with automotive gear shift, gasoline supply train crane and locomotive ditcher; D. L. O'Brien, J. J. Cox, E. P. Brown and Miss H. M. Hoeller.

American Railway Hydrant & Valve Company, Stapleton, S. I., N. Y.; stock yard cocks, hog drenchers, coach yard hydrants, also literature and blue prints; W. Volkhardt.

American Tar Products Company, Pittsburgh, Pa.; literature and photographs; Parker T. Spinney and S. J. Katz.

American Valve & Meter Company, Cincinnati, Ohio; model of Poage water column with telescopic spout and literature on railway water service; J. T. McGarry and Dan J. Higgins.

Barco Manufacturing Company, Chicago; flexible ball joints and lubricated plug valves; Frank B. Nugent and W. C. Motter.

Barrett Company, New York; roofing materials and literature; F. S. Nichols and J. E. Haynes.

Beaver Products Company, Inc., Buffalo, N. Y.; roofing, wallboard, plaster, shingles and literature; H. M. Butters.

Binks Spray Equipment Company, Chicago; paint spraying equipment; F. Van de Bogart.

Carter Bloxonend Flooring Company, Kansas City, Mo.; samples of built-up wood block flooring, literature and photographs; A. W. Giese and C. J. Carter.

Celotex Company, The, Chicago; exhibit showing Celotex used as sheathing, as plaster base, under finished flooring as a sub-floor; Acousti-Celotex used for sound treating in wire and telephone rooms and special board insulation for refrigerator cars; J. H. Bracken and E. E. Kelly.

Chicago Bridge & Iron Works, Chicago; photographs and literature of water tanks; E. P. Shelton.

Cullen Friestedt Company, Chicago; moving picture of steel burro crane and 180 deg. swing crane; Thomas D. Crowley, E. V. Cullen and F. J. Reagan.

Dearborn Chemical Company, Chicago; samples of chemically compounded rust preventive and photographs of actual use; C. F. Barham, Jr., and W. D. Bennett.

Detroit Graphite Company, Detroit, Mich.; literature; W. D. Waugh, L. F. Flanagan, L. D. Mitchell and A. B. Edge.

Detroit Steel Products Company, Detroit, Mich.

DeVilbiss Company, Toledo, Ohio; paint spray equipment

for bridges and buildings; E. G. Whitmore, E. F. Holly and G. H. Buzzard.

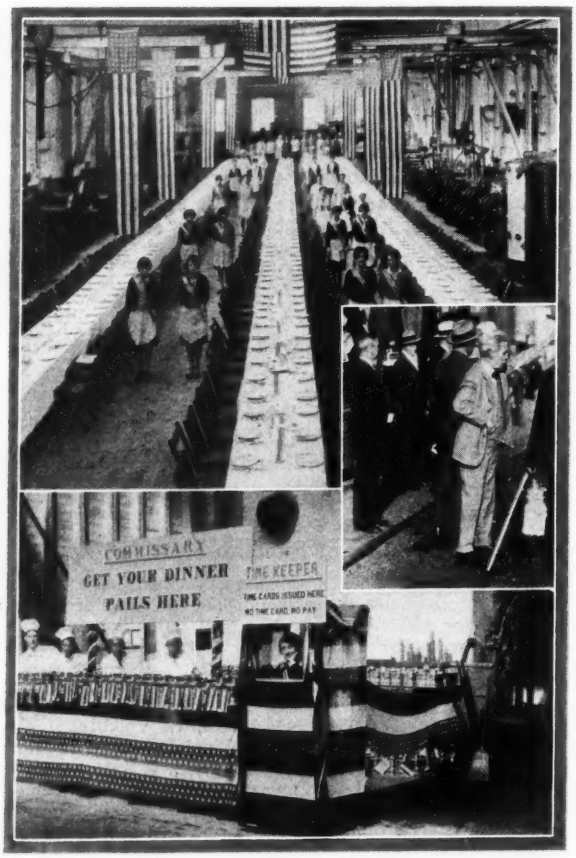
Dickinson, Paul, Inc., Chicago; models of cast iron camp car jack, ventilators and chimneys for small buildings, scuppers, smoke protection plates, exhaust heads and cast iron roof drains; A. J. Filkins and A. E. Engman.

Dixon Crucible Company, Joseph, Jersey City, N. J.; paint literature; H. A. Nealley and P. H. Griffin.

Duff Manufacturing Company, Pittsburgh, Pa.; bridge jacks; C. N. Thulin.

Dunham Company, C. A., Chicago; thermostatic radiator traps, float traps, strainers, radiator valves, medium pressure traps and lift fittings; C. E. Roscoe.

Fairbanks, Morse & Co., Chicago; literature, F. M. Condit, G. Howard, B. S. Spaulding, T. H. Gilleland, Charles H. Wilson, E. C. Galloday, H. J. Smith, J. C. Flanagan and F. C. Lee.



The "Bridge Gang" at the American Hoist & Derrick Company's Plant

Above: Lunch was served in the engine erecting shop. Below: Each member of the gang received a "Full Dinner Pail." At right: F. J. Johnson (A. H. & D. Co.) enthuses over his equipment

Fairmont Railway Motors, Inc., Fairmont, Minn.; bridge and building motor car engine (cutaway model), wheel, axle and bearing display stand; W. D. Brooks, E. R. Mason, K. K. Cavins and C. F. Green.

Federal Engineering Company, Chicago; Joseph A. Nelson.

Hastings Signal & Equipment Company, Boston, Mass.; automatic tell-tale hanger and replacer and side clearance; Joseph E. Freeling and R. W. Hastings.

High Grade Manufacturing Company, Cleveland, Ohio; literature and samples of roofing cement; S. A. Baber and J. N. Kinn.

Ingersoll Rand Company, New York; safety saw and literature on bridge repair and maintenance of way outfits; G. W. Morrow.

Insulite Company, Minneapolis, Minn.; wood fibre insulation board; D. D. Grassick.

Jennison-Wright Company, Toledo, Ohio; Kreolite wood blocks.

Johns-Manville Corporation, New York; samples of roofing, pipe and boiler insulations, packing, shingles, corrugated siding and roofing, waterproofing, industrial flooring and smoke jacks; H. Flannagan, W. H. Lawrence and J. C. Younglove.

Johnson, Edward E., Inc., St. Paul, Minn.; well screens; G. E. Bodien and E. E. Johnson.

Jones Paint Company, The, Rome, N. Y.; liquid and plastic roofing cement; A. deWolfe Jones.

Jordan Company, O. F., East Chicago, Ind.; literature on ballast spreader and track oiler; A. L. Greenabaum, C. H. Staples, H. W. Pretzeller and J. C. Forbes.

Kaustine Company, Inc., Perry, N. Y.; literature on chemical toilets and septic tanks; Charles F. Smale and D. A. Evans.

Knickerbocker Roofing & Paving Co., Chicago; Mark Cronin.

Lehon Company, The, Chicago; samples of asphalt roofing and shingles, waterproofing and roof coatings and asbestos singles; Tom Lehon, J. W. Shoop, M. F. Clarity and John E. Eipper.

Lewis Asphalt Engineering Corporation, New York; samples of waterproofing and literature; H. O. Johnston and A. C. Hanson.

Lowe Brothers Company, The, Dayton, Ohio; Langley Ingraham.

Massey Concrete Products Corporation, Chicago; photographs and literature of reinforced concrete products; D. A. Hultgren, W. Lyle McDaniel and C. H. Hunsaker.

Mudge & Co., Chicago; Class W engine and two-speed transmission used on Mudge W.S.-3 heavy duty cars and Mudge Class C.-1 centerlight motor car; Clyde P. Benning, Achille P. Grenier and Arthur R. Fletcher.

Murdock Manufacturing & Supply Company, The, Cincinnati, Ohio; hydrants, railway water service box and drinking fountains; J. C. Endebrock.

National Lead Company, New York; truss bridge model showing red lead coatings; F. E. Dodge, F. M. Hartley, Jr., A. H. Sabin, W. S. Carlisle and S. A. Bushnell.

Nelson Manufacturing Company, B. F., Minneapolis, Minn.; insulation and roofing material; E. H. Mortimer, E. R. Nelson, E. H. Batchelder, Jr., K. T. Batchelder, G. M. Houghton and James Lowe.

Nelson & Sons, Jos. E., Chicago; literature and photographs; John E. Nelson, I. B. Tanner, D. O. Dugger and Walter Bennett.

Northwestern Motor Company, Eau Claire, Wis.

Norton, A. O., Inc., Chicago; bridge jacks; R. J. McKay.

Otley Paint Company, Chicago; paints, varnishes and enamels; Walter A. Otley, R. M. Chissom and Mark Clarity.

Patterson Company, W. W., Pittsburgh Pa.; tackle blocks; W. W. Patterson, Jr.

Patterson-Sargent Company, Cleveland, Ohio; G. H. Anderson, W. H. McBride and L. J. McCombs.

Phelps-Drake Company, Minneapolis, Minn.

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.; literature; I. A. Bickelhaupt and James L. Dailey.

Pittsburgh Plate Glass Company, Paint and Varnish division, Milwaukee, Wis.; paints; H. J. Brand.

Pocket List of Railroad Officials, New York; copies of publication; B. J. Wilson.

Polaris Concrete Products Company, West Duluth, Minn.; E. H. Dresser and T. O. McLeod.

Railroad Water & Coal Handling Company, Chicago.

Railway Engineering and Maintenance, Chicago; copies of Railway Engineering and Maintenance, Railway Age and Railway Engineering and Maintenance Cyclopedia; Elmer T. Howson, F. C. Koch and J. M. Rutherford.

Robertson Company, H. H., Pittsburgh, Pa.; samples of protected metal roofing and siding, permanent forms, ventilators, skylights, sash, sheet lights and literature; J. R. Sexton and T. C. Russell.

Robertson & Co., William, Chicago; cinder conveyor literature; R. F. Repasz and William Robertson.

Ruberoid Company, New York; C. H. McCormick.

Sherwin-Williams Company, Cleveland, Ohio; Arthur Larkins.

SiFo Products Company, St. Paul, Minn.; roofing materials; E. D. Langan and G. L. Nye.

Snow Construction Company, T. W., Chicago; literature; O. T. Snow.

Templeton, Kenly & Co., Ltd., Chicago; bridge jacks, pipe pusher, and bell base screw jacks; J. L. Crowley.

U. S. Wind Engine & Pump Company, Batavia, Ill.; literature on tanks, steel towers, water columns, pumps, tank fixtures, float valves and tank appurtenances; C. E. Ward.

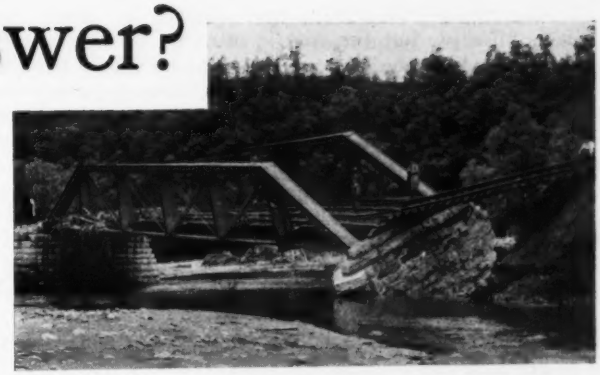
Wood Conversion Company, Cloquet, Minn.; Balsam wool insulation, Balsam wool acoustical treatment and wood fibre insulating board; D. H. Corlette and W. E. Wheelock.

Woolery Machine Company, Minneapolis, Minn.; heavy duty 10-hp. motor car; H. A. Rogers, H. E. Woolery, D. A. Woolery and C. E. Berg.

Zitterell-Mills Company, Webster City, Iowa; photographs; J. A. Bateman.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities



QUESTIONS TO BE ANSWERED IN THE JANUARY ISSUE

1. *When new tie plates are installed at the time of laying new rail, what measures should be taken to insure that the gage will be correct when the plates have become firmly embedded in the ties?*
2. *What is the best method of illumination for emergency work at night, such as driving temporary trestles at washouts?*
3. *Should flanger signs be left in place permanently or should they be installed each autumn? If the latter method is preferred, what is the best type of post to use?*
4. *What is the best method of cleaning out downspouts which have become clogged with ice?*
5. *What advantage, if any, is gained by scalping weeds and grass off the sub-grade from the ballast line to the edge of the roadbed on fills or to the back line of ditches in cuts?*
6. *When handling muddy water, what precautions should be taken with the packing glands of triplex or other plunger pumps to prevent leakage past scored plungers without overloading the power unit?*
7. *When lining curves on steep grades where the rail is tight and inclined to kick out, does it make any difference whether the work is carried up the grade or in the opposite direction?*
8. *What are the relative merits of steel rails and angle irons as nosings for bridge piers?*

Protection of Untreated Piling at the Ground Line

What can be done to prevent the decaying of untreated piles at the ground line?

Decay Can Be Retarded but Not Prevented

By I. L. Simmons
Bridge Engineer, Chicago, Rock Island & Pacific, Chicago, Ill.

I know of no wholly successful method of preventing decay in untreated piling at the ground line. Various methods have been tried with more or less success, such as incasing the piles in tin, putting a band of concrete around the pile at the ground line, or coating the pile at the ground line with tar or asphalt. I believe the latter method to be the most effective, although it is not our practice to use any of these methods as nearly all of our piling are treated.

One of the best and safest methods to pursue is to see that the ground around the pile is kept cleared of vegetation and decaying matter. In this way one might prolong the life of the piling, but he would not prevent decay.

Apply Creosote to the Pile from Two Feet Below the Ground Line to Two Feet Above

By F. H. Cramer
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

The Burlington uses treated piles to a very great extent and consequently this problem is not very serious on that road. We have, however, had occasion to deal with this matter and it is our practice to excavate around the pile to a depth of 2 to 2½ ft. below the ground line for the purpose of inspection. If the pile shows any signs of decay, it is allowed to dry out and then an application of creosote is made, swabbed on hot, from the bottom of the opening to a height of about two feet above the ground line. This method has proved effective and economical in prolonging the life of untreated piling. The best results, of course, are obtained by applying the creosote as soon as the first indications of decay are observed.

Preventing Scour in Cut Ditches

What steps can be taken to prevent the scouring of ditches in heavy grades where a large amount of water must be taken care of?

Various Methods May Be Used

By A. E. Preble
Supervisor, Pennsylvania, Reading, Pa.

Water spread out in thin sheets is harmless but when confined in bulk has tremendous force. In dry seasons the cut ditches along the tracks where there are heavy grades appear innocent to the casual observer but not so to the trackman because he knows that in storm conditions these ditches often become raging torrents, scouring the bottom and sides and causing considerable damage. The observant engineer, roadmaster or foreman will take precautions to prevent this scouring and here his ingenuity is expressed in meeting the situation.

Some of the methods used successfully where this condition must be taken care of are as follows:

1. Concreting the bottom and sides of the ditch. This is effective but the cost is often prohibitive.

2. Riprapping the bottom and sides of the ditch with spalls, paving block or cobbles, then grouting to prevent undermining.

3. Allowing a good sod to bed itself, taking care to prevent a ragged condition to obstruct the flow of water.

4. Constructing diverting ditches whenever practicable to dissipate the bulk of water and lessen the scouring conditions.

Paving Is Effective Where Trouble Is Severe

By C. J. Lepperd
Supervisor, Reading, Pottstown, Pa.

Probably the surest method of preventing scouring is to pave the ditch. The amount of scour and the importance of the ditch will determine the allowable expenditure. An economical method is to pave the bottom of the ditch with rough stones set on edge. If one-man or larger stones are used and well placed with smaller stones between, they will provide a very effective paving.

If the amount of scour does not warrant the expenditure necessary to pave the ditch with stone, another effective plan is to place old ties or timbers across the bottom of the ditch to form a series of dams which will catch the scour and break up the current. If the water overflowing these dams tends to scour, they may be built in several steps to lessen the force of the fall.

Hook Bolts for Bridge Ties

Is it necessary to use hook bolts where bridge ties are dapped? What should be the minimum depth of dap where hook bolts are not used?

Hook Bolts Are of Doubtful Utility

By Phillip George Lang, Jr.
Engineer of Bridges, Baltimore, Ohio

The reason for the use of the hook bolt in timber floor bridges has rarely been defined. The advantages claimed for the hook bolt include the prevention of the tie tipping in case of derailment or floating away in floods, and the retention of the tie in a lateral position on both tangent and curved track. Because of vibration it is difficult to hold the hook bolt in position, and, if it turns through an angle of 90 deg., its utility is obviously at an end. In cases of derailment, hook bolts have been known to straighten out, and hence not perform the service expected.

The use of hook bolts is not recommended, as they are expensive and of doubtful utility. Ties, however, should be dapped not less than ½ in. nor more than 1½ in., and the minimum distance from the edge of the dap to the end of the tie should be 6 in. Where rivet heads occur in top flanges it is to be noted that they also serve to hold the tie in position.

The Purposes for Which Hook Bolts Are Used Can Be Better Served by Other Means

By Inspector of Bridges

The hook bolt is a relic of the past, supposed to have several different functions which it usually performed in an indifferent manner. As a result other means have now been generally adopted to secure the ends for which the hook bolt was designed.

The principal functions of hook bolts are to prevent the lateral movement of the ties on the members by which they are supported, and also to prevent their being lifted from the bridge in case of high water which overtops the track. When the ties are dapped over the members of the floor system this prevents their lateral movement, and hence the principal remaining use of the hook bolt is to anchor the track to the steel. This can be done more effectually by means of anchor bolts with nuts since the hook bolts are apt to turn, due to the vibrations caused by traffic, and to lose their effectiveness unless they are inspected and adjusted frequently.

The minimum depth of daps should be ½ in. and this should also be the maximum depth except where necessary to secure an even grade over coverplates, etc. The timber cut away by dapping decreases the effective thickness of the tie and where the daps are deep this often becomes a serious matter.

Broken Bolts on New Rail

On a new line laid with 90-lb. rail, trouble has been experienced with broken bolts. The track is well ballasted, all ties are tie plated and line and surface are excellent. Apparently sufficient allowance has been made for expansion, but the angle bars are "frozen," some joints are tight, while others have too large a gap and there is no movement in others. An average of 10 to 12 bolts have broken daily over a period of several months. What is the cause of the bolts breaking?

Probably Caused by Bolts Being Too Tight

By Division Engineer

While the description of the trouble experienced is very clearly presented it is not an easy matter to give a final opinion without an opportunity to study the situation on the ground where some of the possibilities might be eliminated and a further study made of those which seem to have a more definite bearing on the problem.

One of the characteristics of the joint fastenings used probably is a snug fit between the fishing surface of the rail and the angle bar. While nothing is said as to the kind of bolts used, they are probably heat treated, and with such bolts it is possible to obtain a tension as high as 26,000 lb.

At the convention of the American Railway Engineering Association in March, 1926, the Committee on Rail, in conjunction with a special committee which is studying stresses in track, reported on tests which had been made to determine the effect of bolt tension on the mechanical strength of joints. Field tests and observations were made on stretches of track on the Nashville, Chattanooga & St. Louis and the Chicago, Burlington & Quincy, while laboratory tests were made at the Engineering Experimental Station at the University of Illinois.

It was found, in general, that for freedom of movement in joints, bolt tension should not exceed 15,000 lb. and that for the necessary strength of the joint the minimum tension should not be less than 10,000 lb. During these investigations, which were made on 100-lb. rail with 1-in. bolts, it was ascertained that with "free turn" or "finger turn" bolts a wrench 36-in. long would secure a tension of 20,000 lb. on the bolt. The same wrench would secure a tension of only 10,000 lb. on "wrench fit" bolts; a 42-in. wrench, 12,500 lb. and a 48-in. wrench 20,000 lb.

Most bolt failures are due to the fact that the tightest bolts bear most of the burden of impact,

resulting in their being stretched beyond their elastic limit. Bolts that are turned up too tight have two undesirable features: First, they cause the angle bars to grip the rail so tightly that there is no opportunity for the free movement of the rail in the joint which is necessary to accommodate the expansion due to temperature changes; and second, the bolts are quite likely to break.

It has been proved conclusively that the use of oil on the fishing surfaces of a joint does not aid the movement of the rail when the tension in the bolt exceeds 3,000 lb. Even if it did, it is not feasible to keep all the joints on a section properly oiled.

Unless the work of tightening bolts is given closer supervision than it usually receives, it almost never happens that the bolts will have the same tension. For this reason some joints will be very tight, while the tension of the bolts in others will be much less. The result of this is that often from 2 to 20 rails, and in some instances even more, will act as a unit because the bolts are so tight that the rails cannot move in the joints. In such cases, when the stresses in the rail due to temperature changes reach a certain point, the rail moves in the joints where the smaller bolt tension exists, causing the joint to have an improper expansion gap, while the expansion gaps in the joints with the very tight bolts will remain unchanged.

Based on the question as stated it is probable that the bolts in most of the joints are too tight to permit the proper movement of the rail under temperature changes, and this conclusion is borne out by the fact that the joints are frozen.

Bolts Are Probably Too Tight

By Fred Lange
Section Foreman, Northern Pacific, Moorhead, Minn.

My opinion is that the trouble is due to the bolts being too tight as this will "freeze" the anglebars, preventing proper expansion and putting an excessive strain on the bolts at the joints which do open. No mention is made as to the track being anchored, which would prevent these excessive strains. Since it is a new line there is probably more wave motion in the track than would occur on a seasoned roadbed and this also increases the strain on the bolts under traffic. This all points to over-tightening which destroys the resilience of the bolts.

Suggestions Only Can Be Made from the Data Presented

By C. W. Baldrige
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago, Ill.

Answering the question why track bolts are breaking is very much like a doctor diagnosing a case by mail. To determine the cause of the bolts breaking, one should go over the track and make a careful study of all the factors, following up with a laboratory study of the bolts. A few suggestions as to what may be the trouble are as follows:

The fact that the angle bars are "frozen" indicates that wrenches of too great length have been used, resulting in the bolts being too tight.

It is possible that the original installation of bolts was a lot which had been heat treated at too high a temperature, thus weakening them instead of increasing their strength. If the breakages are confined to the original bolts, this is apt to be the case. To determine whether or not this is the case, a supply of the broken bolts should be sent to some experienced engineer of tests for study.

The kind of springs or spring washers used, if any, may have something to do with the trouble. The size of the bolts, the pattern and fit of the joint bars and perhaps other conditions also need to be studied.

Insufficient Anchoring of the Rail Is Indicated

By W. H. Cleveland
General Track Inspector, Atchison, Topeka & Santa Fe, Western Lines, Wellington, Kan.

This condition denotes uncontrolled longitudinal rail creeping due to insufficient rail anchorage at vulnerable locations, resulting in bunched rail at opposing grades, or forces; also a non-uniform wrenching of the bolts, with some bolts tightened to over tension.

To remedy this condition, the rails should be readjusted to uniform joint expansion. Sufficient rail anchors should be placed to control rail creeping on all descending grades. When the current of traffic is in one direction, this should be sufficient anchorage, as opposing grades will then usually remain quiet. The bolts should not be over-wrenched but should be brought to a medium uniform tension. The use of nut locks is a valuable factor in overcoming joint freezing and bolt breaking, and oiling the angle bars before applying them is beneficial.

Breakage of Glass in Skylights

What is the best method of preventing the breakage of glass in skylights?

Frames Should Be of Substantial Construction

By Assistant Engineer of Buildings

The breakage of glass in skylights is apt to be great enough to be both annoying and expensive unless the frame supporting the glass is rigid. For that reason it is our custom to reinforce the sheet metal frames with angles or channels to furnish this necessary strength. With this detail taken care of, the two principal sources of breakage are found in vibration of the building and securing the glass so rigidly in the frames as to prevent the free expansion and contraction of the glass due to temperature changes.

In order to counteract both of these conditions a layer of roofing felt should be placed on the metal frame to keep the glass from coming in contact with the metal, this cushion lessening the vibration of the glass and also providing a compressible substance which adjusts itself to expansion and contraction of the glass. We have used corrugated glass for skylights in a number of instances and find that there is less breakage with this type than with the plain glass.

It Depends Upon the Cause of Breakage

By E. L. Mead
Division Engineer, Chicago & North Western, Chicago

The methods of preventing the breakage of glass in skylights will depend on the cause of the trouble. Probably the greatest contributing cause is due to the failure to provide for the expansion and contraction of the glass, while vibration of the structure, especially in shops where heavy machinery is operated, is also a factor.

We have found that a large number of panes break in metal sash where the glass is supported directly by the metal and where no space has been left for the

expansion of the glass. This condition is remedied by inserting a pad of felt or a layer of an asphaltic preparation between the glass and the metal of the frame to avoid transmitting the shocks of vibration to the glass, and also to permit the necessary expansion.

We use wire glass for skylights and in many places, such as shop buildings or similar structures, we are able to secure additional life from cracked panes by filling the cracks with a putty with asphaltic ingredients. This makes a black steak across the glass but where appearance is not a factor its use has proved satisfactory and economical in preventing leakage.

Use of Track Jacks Between the Rails

Do situations ever arise in routine track work when it is necessary to use a track jack inside the rail? If so, what procedure should be followed when this is done?

Sometimes Necessary Along Platforms or Intertrack Fences

By J. J. Desmond

Roadmaster, Illinois Central, Chicago

The occasions for using track jacks inside the rail arise most frequently where elevated platforms are maintained adjacent to the track or where intertrack fences are installed and such conditions are more often found in station grounds and terminals than out in the open country. Whenever it is necessary to use the jacks between the rails it should be considered that the track is obstructed and proper provision made for flagging as is required by the rules in such cases.

Should Be Seldom Necessary

By J. B. Martin

General Inspector of Track, New York Central, Cleveland, Ohio

Track jacks inside the rail form dangerous obstructions which cannot be removed readily, hence they should not be so used except in situations which will not permit the work to be done otherwise. Such situations should be rare and when they are encountered the work should be protected according to the rules of the railroad the same as any other obstruction.

Fire Protection for Pump Houses

What fire protection equipment should be provided for pump houses where motors or internal combustion engines are installed?

Should Include Construction and Care of Building as Well as Equipment for Fighting Fire

By H. Pollard

General Fire Inspector, Southern Pacific, San Francisco, Cal.

Fire protection provided for facilities of this kind should be taken care of first in the type of building and the manner in which the power wires are installed or the oil or gasoline are stored or used; the care with which the house is maintained and then the proper fire protection necessary to deal with permanent installations, without taking into account those of a temporary or emergency nature.

The building, including the roof and floor should be of a fire resisting material, such as concrete, brick, tile or other similar character and should be of a size sufficient to prevent crowding of the machinery.

Power wires should enter the building in conduits and the entire electrical equipment should be installed in accordance with the National Code to meet the requirements of the Fire Underwriters. Gasoline or oil should be stored outside the building in underground tanks and pumped to the point of consumption. If gasoline or oil with an equal flash point is kept inside the building it should be contained in approved safety cans in as small quantities as is practicable. The housekeeping should be carefully looked after and waste and rags should be kept in metal covered cans, preferably of the automatic closing cover type. Metal lockers should be provided for clothing.

The fire protection facilities in buildings of this kind can be very simple. For the motors, one or two carbon tetrachloride fire extinguishers of one quart capacity should be provided. For internal combustion engines one or two 2½-gal. foam-type extinguishers should be furnished. A box of sand and a scoop shovel should also be installed.

Chemical Fire Extinguishers Should Be Installed

By W. E. Warner

Brentford, England

The fire protection equipment installed in a pump house of this kind should include chemical fire extinguishers, varying in number according to the size of the building, but not less than six, located in different parts of the building. Fire buckets filled with sand, a mixture of sawdust and salt or some other fire resisting compound should also be provided. Water is useless in fighting fire when gasoline is involved and chemical fire extinguishers are necessary. If large quantities of gasoline are stored in the building electric lights should be installed to avoid the necessity of naked lights.

Precautions to Be Taken Around Derailed Cars Containing Gasoline

What special precautions should be taken when working around cars which contain gasoline and which have been derailed or are leaking?

Open Lights Must Be Avoided and the Gasoline Prevented from Spreading

By J. M. Sills

Division Engineer, St. Louis-San Francisco, Springfield, Mo.

In case cars containing gasoline have been derailed or are leaking, it is imperative that all open flames of any sort be eliminated from the vicinity of the derailment or leaking gasoline. Tanks containing casinghead gas can generally be recognized because it is put in insulated cars. Where casinghead gasoline is involved, the danger is great, not only in the immediate vicinity of the gasoline but often at a considerable distance away, owing to the fact that the gasoline is volatile and becomes a heavy gas lying close to the ground. This can be blown by a breeze along the ground for a considerable distance and it is therefore necessary that locomotives, lanterns and smoking of any kind, or anything that might cause a spark, be kept just as far away from the gasoline as possible.

If possible to secure one, it is always advisable to cover the car with a tarpaulin which, especially if the derailment occurs in a city, will reduce the tendency to ignition from sparks flying through the air, such as from adjacent stacks. Trenches should be dug quickly and any gasoline on the ground in any quantity should be buried in the trench as rapidly as possible and covered with cinders and then with earth. It is also advisable to absorb as much of the gasoline on the ground as possible by covering it with cinders and earth or any other material available—sometimes wet gunny sacks can be used to

advantage for covering. In case fire starts with ordinary gasoline, it is a comparatively simple matter to put it out with a wet blanket, gunny sack, dry sand or earth, or even cinders. Live steam, also, will stop a gasoline fire very quickly. If casinghead gas is involved and there is some pressure, which is always the case in these cars, it is difficult to suppress. It is dangerous to allow gasoline to run into a sewer of any sort as this might cause a very serious explosion.

If the leak or opening caused by the derailment can be reached, it is, of course, advisable to stop it immediately, by the best means available; then a pipe line should be run from the car in trouble for the purpose of pumping the remaining gas to an empty tank car. This will have to be done after all possible precautions are used to confine the gasoline and its vapor first. It is a good plan to have fire extinguishers on wrecking outfits. The whole idea in handling these cases is to make everything as safe as possible. Gasoline leaks or breaks in the tank car should be closed quickly.

Many Precautions Must Be Taken

By E. J. League
Inspector, Bureau of Explosives, Chicago

The following suggestions and general rules for handling wrecks and derailments involving loaded tank cars is abstracted from Bureau Circular Letter No. 189, which has been issued by the Bureau of Explosives and is available to all railroads.

The clearing up of wrecks or derailments of tank cars of gasoline involves peculiar risks, owing to the large volume of gasoline in the cars and the volatile and inflammable nature of the contents. Owing to the wide diversity of conditions that may exist it is not practicable to draw up regulations for all cases.

Gasoline varies in hazard from the highly volatile casinghead gasolines to those of the ordinary type, the former giving off many times the amount of vapor as does the latter. The vapor is heavier than air and tends to form a layer along the ground, mixing only slowly with the air unless there is a wind. Owing to the variation in the volatility of different gasolines and other conditions, such as the amount of vapor, temperature, slope of the ground, the direction of the wind, etc., it is impossible to fix any definite limit at which the hazard of ignition ceases, but cases have been known where the vapor was ignited 480 ft. from the point of leakage.

Leakage of gasoline should be stopped if possible or the contents of the car transferred. While the gasoline is escaping all naked lights and fires should be kept at a distance, and this should be greater on the leeward side than on the windward. When the gasoline is escaping in large quantities which cannot be controlled, it should be disposed of by leading it to holes dug in the ground and filled with loose earth after the liquid has drained away. Care should be taken not to permit large amounts of gasoline to flow into sewers or water courses, as this may allow the hazard to be carried long distances from the original point of trouble.

The following general rules will serve as a guide in the majority of cases:

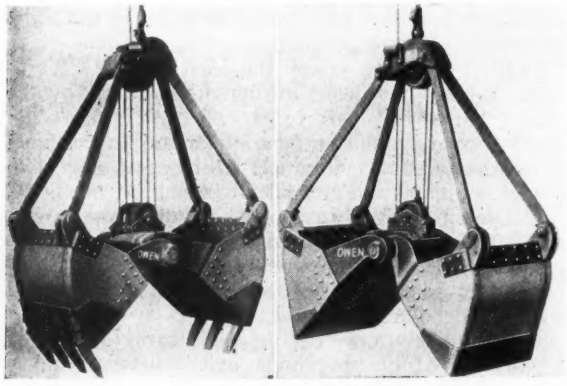
1. Post guards and keep all spectators away.
2. Locate all leaks and stop them if possible, using only electric flashlights or electric hand lanterns when lights are necessary. If open flame lights must be used keep them elevated as much as possible.
3. Dig holes and trenches to bury exposed and leaking gasoline that cannot be transferred promptly to tight containers.
4. Allow a reasonable time after the stoppage of leaking gasoline for vapors to escape from the wreck and vicinity.
5. Keep steam cranes to the windward as much as possible and not less than 500 ft. away until the completion of work to this point.
6. First move to safety the least injured cars to avoid starting new leaks during the handling by the crane. When leaks are to be expected in handling, empty the car first either by transferring the contents to another car or container, or by drainage to a hole or trench in the ground for burial.
7. Do not allow trains to pass on adjoining tracks, especially on the same or a lower level, as long as gasoline is leaking or exposed in quantity. When allowed to pass keep fire doors and ash pan slides closed and the draft shut off.
8. The placing of leaking tank cars for repairs in close proximity to shops where fires or naked lights are maintained must be avoided.

Position Color-Light Signals on the Baltimore & Ohio

New and Improved Devices

Two New Types of Clamshell Buckets

THE Owen Bucket Company, Cleveland, Ohio, has placed on the market two new models of clamshell buckets, one a digging bucket, designated as Type "M," and the other a rehandling bucket, which is known as Type "K." The Type "M" bucket, which is designed primarily for excavating and general purpose work, is made in three models: Standard, Narrow and Special, the latter designation being used for standard or narrow buckets when equipped with special grip-proof arm bracket construction. The Type "K" bucket is likewise made



Type M **Type K**
New Owen Clamshell Buckets

in three models: Standard, Hi-Speed and Special. The Hi-Speed bucket is designed with an exceptionally sharp pitch to the bottom plates for rapid handling of loose materials. Both the Standard and Hi-Speed buckets may be furnished with special grit-proof lubricated bearings, in which case they are known as Type "K" Special.

These two new types replace older types of buckets manufactured by this company, Type "M" Special taking the place of Type "O," Type "M" Standard and Narrow replacing Type "J" Standard and Narrow digging buckets, respectively, while Type "K" replaces the Type "J" rehandling bucket. The new types are really improved Type "J" and "O" buckets, but the changes have been so radical that it was deemed best to give them new designations for the sake of clarity.

The improvements and changes incorporated in these types include a new design of crosshead in one piece having 17 less parts than any previous Owen bucket, making it possible to shorten the arms and thus provide for operation in reduced headroom; protection of the closing cable by eliminating the possibility of its chafing on any part of the bucket; and provision for the protection and lubrication of the main or center shaft bearings, which have double the bearing area of the older types, this feature preventing grit from working into the bearings and assuring clean lubrication.

In the new buckets extra heavy special alloy steel lips extending up the side plates past the wearing point have replaced the flat cutting plates formerly used. It is said that these new lips, with their ability to resist abrasion, have twice the durability of the old plates. The arm brackets are heavier and have greater leverage than those in the former types. The inside contour of the shell is smooth and extra thickness of the angles at the corners of the cutting edges has been eliminated to insure deeper penetration.

A Dual Side-Pivot Drop-Door Dump Car

THE Western Wheeled Scraper Company, Aurora, Ill., has developed and placed on the market a new dump car of the side hinge type which is designated as the Western dual side-pivot drop-door dump car and which is designed to meet the special problems encountered in railway maintenance of way work as well as in open pit mining operations.

The car is of low height, with side pivots or trunnions spaced at sufficient distances so that no locking mechanisms is required. The car can be dumped to either side to an angle of 50 deg. from the horizontal, the doors turning downward as the car body is tilted, to form an apron to prevent the material being dumped too close to the track, the edge of the door being 4 ft. 8 in. from the rail when the car is in the dumped position. The insides of the doors and the ends of the cars are sloped to facilitate the discharge of sticky materials.

Dumping is accomplished by two single-stroke cylinders, 30 in. in diameter, on each side of the car, which exert full pressure on the car body until it reaches an angle of 34 deg., at which point a link arrangement comes into play automatically, enabling the cylinders to push the car body to the full dumping angle of 50 deg. The cars are provided with enamel lined air storage reservoirs of sufficient capacity to dump the cars without depending on additional air from the locomotive. The piping is so arranged that the cars may be dumped to either side, individually or in multple.

When being dumped the bed of the car rotates

about six pivots until it has reached an angle of approximately 40 deg. from the horizontal when the load is transferred to two outer pivots at the bolsters, causing the car body to right itself when the air is released from the dumping cylinders. The inner pivots are located nearer the center of the car than is usual with this type of construction and are set low, thus causing the path of the center of gravity to follow a flattened curve when the car is being dumped and thereby requiring a comparatively small consumption of air. When dumping a uniformly distributed load of 100,000 lb. it is said that the center of gravity is raised only 6½ in., reaching its highest point when the bed is tilted only 27 deg. Accurate tests have shown that capacity loads were dumped with effective cylinder pressures ranging from 45 to

New Type Western Cars Being Dumped on Alternate Sides of a Trestle

52 lb. per sq. in., and that the pressure decreased rapidly as the car was tilted, dropping to less than 20 lb. during the latter part of the travel. The dumping is gradual but continuous and in these tests the load was entirely discharged in from four to five seconds.

The construction of the car body is strong and rigid. The draft sill is composed of two 65-lb. I-beams with ½-in. cover plates on top and bottom, while the side sills are 12-in., 30-lb. channels. Closely spaced cross sills of 8-in. I-beams are fastened securely to the side sills and rest on the draft sill when the car body is in normal position.

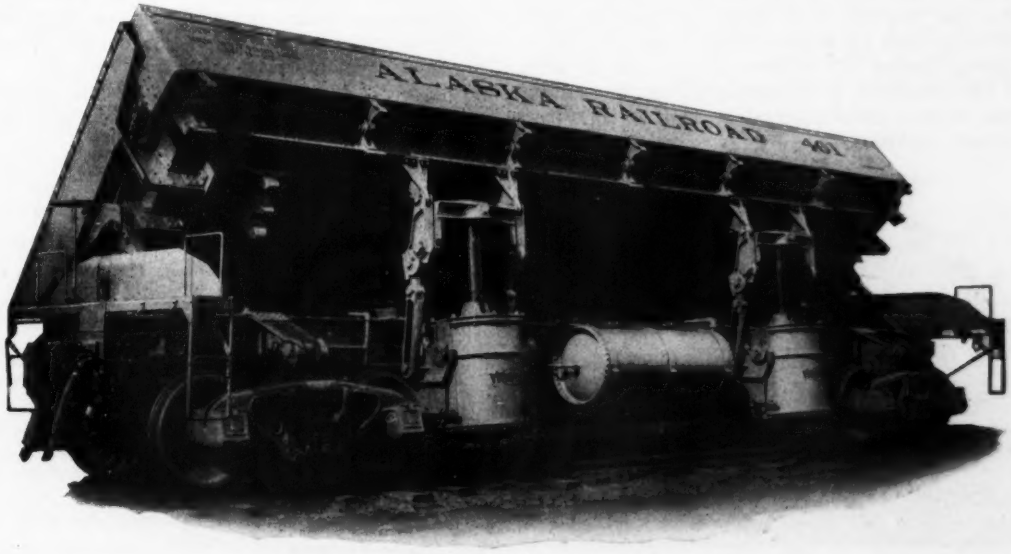
The doors are of double plate design, the plates being connected by ship channels at top and bottom and with vertical diaphragms at all points where they are hinged to the side sills. A constant clearance is maintained between the floor plates and the bottom of the door as the latter is turning downward when the car is assuming the dumping position to prevent the lodgement of material which would interfere with the righting of the car.

The opening and closing of the doors are controlled automatically by a system of simple levers which are located at each end of the car body and are enclosed to prevent their being fouled by material falling from shovel dippers or loading buckets. The mechanism is so designed as to prevent injury in case the down turning door strikes any obstruction along the track, such as previously dumped material. The doors are designed with ample strength to plow through dumped material without being damaged.

A number of these cars, of 25 cu. yd. capacity, are in operation at the Orwell mine on the Mesabe iron range and more have been ordered. Similar cars, of 30 cu. yd. capacity, have also been put in service on the Alaska railroad.

A New Switch Heater

AFTER having been tested last winter with success by a large eastern railroad, a new electrical snow melter for use around switches is being put on the market by the Lundie Engineering Corporation, New York City. This new snow melting device, which is known as the "Elec-traC" heater, was developed specifically with the idea of providing a heater with all of the advantages of electric operation, and in addition, one which would effectively use the greatest possible amount of the heat generated by the heater. In securing this desired efficiency, the new heater is shaped from a heavy flat metal plate in such a way that it has one flat face, and two triangular end pieces which hold the heating element between them. So shaped, the assembled heater fits snugly against the web and flange of the rail, where it has the appearance of a closed box. In this position, it is the function of the heater casing to reflect the heat of the heating element directly

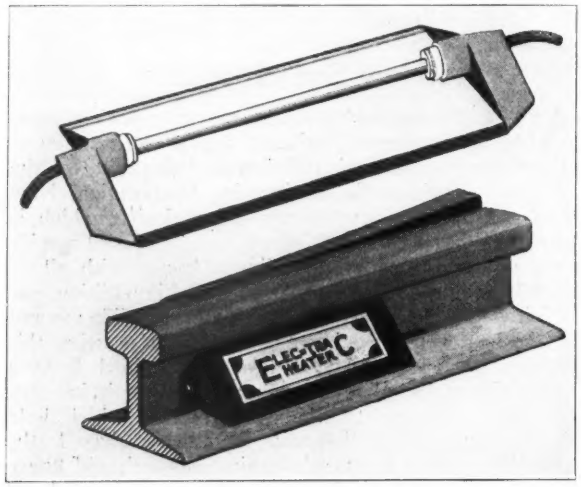


New Drop Door Side Dump Car Built by the Western Wheeled Scraper Company for the Alaska Railroad

against the base and lower portion of the rail. To make this more effective, the inside of the back face of the heater is lined with an insulating material so as to preclude the loss of heat to the atmosphere through radiation. Through such an arrangement, it is claimed that approximately 90 per cent of the heat generated is effective in heating the base of the rail on the side toward the switch point where snow and ice cause the greatest trouble.

The new heaters are bolted in place to the stock and through rails at a switch, so that they are readily installed in the fall and removed in the spring. They are simple in construction and are built of high grade materials to withstand vibration, corrosion and abuse, and give long service without attention. Indicative of their life is the result of a test conducted last winter on one of these heaters which was in service for 3,790 consecutive hours with apparently no ill effects.

Six of these units are usually applied at a switch, and each is rated to consume approximately 660 watts. At a rate of one cent per kilowatt hour, it is evident that 24 hours operation at a switch will cost 95 cents.

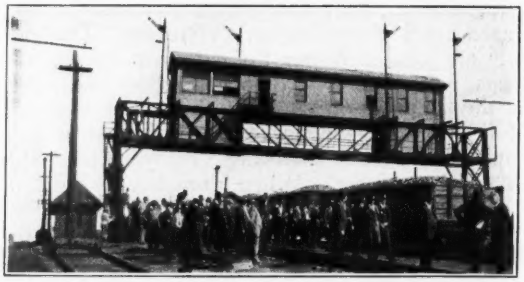


The New Switch Heater

Basing the length of life of these heaters on the prolonged trial of them during the winter of 1926-1927, it is evident that this life is at least one hundred fifty-seven 24-hour days of active service, and a undetermined period longer for active service and between storms. On this basis it is estimated that the average life of the heaters should extend through at least four or five winter seasons.

The Chicago, Milwaukee & St. Paul's Pioneer Limited

With the Associations



The Roadmasters' Association

President J. P. Davis has appointed a committee to investigate hotel facilities in Detroit and recommend a hotel for the next convention, this committee consisting of H. R. Clarke, C. B. & Q., Chicago, chairman; J. B. Martin, N. Y. C., Cleveland, Ohio; G. W. Morrow, Ingersoll-Rand Company, Chicago; E. Keough, American Fork & Hoe Co., Chicago; A. H. Told, Positive Rail Anchor Company, Chicago; J. H. Reagan, G. T., Detroit, Mich.; D. J. Higgins, American Valve & Meter Co., Chicago; and Elmer T. Howson, *Railway Engineering and Maintenance*, Chicago.

The Engineering Association

The various committees are now actively engaged in the completion of their work and the drafting of their reports. Ten committees met during October as follows: Water Service at Chicago on October 4 with 30 present; Ballast at Chicago on the same day with 10 per cent; Masonry at Chicago on October 13-14 with 14 present; Signals and Interlocking at Chicago on October 19; Electricity at Chicago on October 20 with 8 present; Wood Preservation in Chicago on October 25; Economics of Railway Labor at Chicago on October 27 with 14 present; Uniform General Contract Forms at New York on October 31 and Grade Crossings at Chicago on the same date. The report of one committee, Water Service, has already been turned over to the secretary in practically complete form.

Work on the construction of the car for the detection of transverse fissures is rapidly approaching completion and it is expected that it will be placed in service on the New York Central early in November. If the results measure up to expectations, it is expected that it will operate for ten days on each of eight roads.

Directory of Associations

American Railway Bridge and Building Association.—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 16-18, 1928, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 6-8, 1928, Palmer House, Chicago.

American Wood Preservers' Association.—E. J. Stocking, secretary, 111 West Washington street, Chicago. Next convention, January 24-26, 1928, Montreal, Que.

Bridge and Building Supply Men's Association.—W. D. Waugh, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers.—E. A. Morse, secretary, Potosi Tie & Lumber Company, St. Louis, Mo. Next convention, April 24-26, 1928, Arlington Hotel, Hot Springs, Ark.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Detroit, Mich.

Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

The Material Market

ORDERS FOR rail placed during the month of October, together with specific inquiries for rail requirements, totaled approximately 700,000 tons. The orders placed included 190,000 tons for the Santa Fe, 60,000 for the Burlington, 55,000 tons for the Chesapeake & Ohio, 30,000 tons for the Union Pacific, 35,500 tons for the Reading, 17,000 tons for the Lackawanna, and 50,000 tons for the Canadian National. The largest inquiry still pending is that of the New York Central for 190,000 tons, in addition to which the Erie is in the market for 46,000 tons, the Missouri-Kansas-Texas for 12,500 tons and the Grand Trunk for 10,000 tons.

While orders for track accessories have followed as a natural consequence of the rail purchases, they have not been proportionate to the volume that must eventually result. The Union Pacific ordered 3,000 tons of miscellaneous track material and the Southern Pacific has placed orders for 6,000 kegs of spikes. The Chesapeake & Ohio has ordered 2,000,000 tie plates. The Pennsylvania is inquiring for from 100,000 to 200,000 tie plates, while the Santa Fe is also making inquiries covering its needs in accessories.

Iron and Steel Prices Per 100 Lb.

	September		October	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80 to $2.90	$2.90	$2.80	$2.80
Track bolts	70% off list	3.90	3.80	3.80
Angle bars	2.70	2.75	2.75	2.75
Tie plates, steel	2.35	2.35	2.25	2.25
Boat spikes	3.10	3.10	3.10	3.10
Plain wire	2.40	2.45	2.40	2.45
Wire nails, keg	2.55	2.60	2.55	2.60
Barb wire, galv.	3.25	3.30	3.25	3.30
C. I. pipe, 6 in. to 12 in., ton		$34.20 to 37.20		$34.20 to 37.20
Plates	1.75 to 1.85	1.85 to 1.90	1.75	1.85
Shapes	1.75 to 1.85	1.85 to 1.90	1.75	1.85
Bars, soft steel	1.75 to 1.85	1.85 to 1.90	1.75	1.85
Rivets, struc.	2.75 to 3.00	2.85 to 3.10	$2.75 to 3.00	2.85 to 3.10
Conc. bars, billet	1.75 to 1.85		1.75 to 1.80	
Conc. bars, rail	1.65 to 1.75	1.90	1.65 to 1.75	1.90
Rails, per gross ton, f.o.b., mills		43.00		43.00

No Marked Increase in Production

Owing to the fact that at least a part of the rail purchases made or in immediate prospect do not call for deliveries until after January 1, 1928, this volume of new steel business has not caused any marked impetus in production, although it has resulted in some actual increase in ingot output in the Chicago territory. The orders for fastenings have not as yet been sufficient to influence production to any appreciable extent.

With the exception of the rail orders and a considerable volume of structural steel awards in which the railroads have been represented, the demand for steel is exceedingly limited. Production has been curtailed in consequence, now amounting to less than 55 per cent of capacity in the Pittsburgh district and prices have suffered a further reduction. For the first time in many months decreases are recorded in track materials. Spikes, bolts and tie plates are now quoted at 10 cents per 100 lb. less than the previous levels. The effort to stabilize prices of structural plates, shapes and bars at $1.75 per 100 lb. for large orders and $1.85 (Pittsburgh) for small quantities, noted last month, proved unavailing, for the price seems now established at $1.75 for all ordinary business, with $1.80 demanded for undesirable orders, while less than $1.75 has been quoted for especially attractive business.

In the case of structural rivets the manufacturers raised the price for fourth quarter business from $2.75 to $3.00 (Pittsburgh), their most recent action being to set October 20 as the last date on which orders could be placed at the lower price. However, the demand is limited and production is estimated at only 50 per cent of capacity.

Wire nails have been quoted at $2.55, Pittsburgh, and $2.60, Chicago, since June, but some buyers had not specified fully against orders at the old price and it is understood that some makers are still filling these old orders at the lower price. As a consequence, the higher quotation is not fully established.

The scrap market is inactive and little tonnage is moving. Prices as seen in the table have suffered a decline during the past month after a moderate advance during September.

Scrap Prices Per Gross Ton at Chicago

	September	October
Relaying rails (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	15.25 to 15.75	14.50 to 15.00
Rails less than 3 ft. long	15.50 to 16.00	14.75 to 15.25
Frogs and switches cut apart	14.00 to 14.50	12.75 to 13.25
Steel angles bars	13.75 to 14.25	13.50 to 14.00

Lumber Market Inactive

The declining price tendency noted in steel products is also manifest in other lines, including lumber. Southern Pine mills are doing more business and are producing in larger volume than a year ago, but the unfilled orders on hand are in smaller volume. Business on the West Coast is slow and prices are weak. The movement of hard wood, which was very active during the summer, is now decidedly slack.

Southern Pine Mill Prices

	October
Flooring, 1x4, B and B, flat	$35.52
Boards, 1x8, No. 1	32.38
Dimension, 2x4, 16, No. 1, common	23.40
Dimension, 2x10, 16, No. 1, common	25.36
Dimension, 2x4, 16, No. 2, common	20.53
Dimension, 2x10, 16, No. 2, common	19.92

Douglas Fir Mill Prices

	October
Flooring, 1x4, B and btr., flat	$24.50
Boards, 1x8, No. 1, common	16.25
Dimension, 2x4, 16, No. 1, common	18.00
Dimension, 2x10, 16, No. 1, common	18.00
Timbers, 3x3 to 4x12, No. 1, common	19.00
Timbers, 5x5 to 12x12, No. 1, common rough	17.50

In the table of Portland cement prices shown below that for New Orleans represents an advance of 10 cents. These prices are per barrel in carload lots, not including package:

New York	$2.03	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.07	Dallas	2.05
Chicago	2.05	San Francisco	2.51
Cincinnati	2.32	Montreal	1.41

Ore Docks of the Duluth, Missabe & Northern at Duluth, Minn.

Railway News Briefly Told

The Baltimore & Ohio's centenary and pageant, "The Fair of the Iron Horse," closed on October 8, after having been open for three weeks and one day. The total attendance was 1,250,000 and on the last three days the average attendance was 100,000.

The Norfolk & Western has completed the first of 30 locomotive tenders with a capacity of 18,000 gal. of water and 26 tons of coal. They are 44 ft. 10¾ in. long, from face of buffer to face of coupler, and are carried on six-wheel trucks. The total loaded weight of the tender is 312,800 lb.

According to the summary of railway accidents issued by the Interstate Commerce Commission, only two passengers were killed in train accidents in the first six months in 1927, constituting an unparalleled record. One of these deaths was due to a collision and the other to a derailment.

Senator Brookhart, of Iowa, has announced that he intends to introduce a bill at the coming session of Congress under which the federal government would acquire control of the railroads by condemnation of their capital stock and turn them over to a private corporation with a small capitalization for operation.

Approximately 174,000 fewer cars will be required for the transportation of 27 of the principal commodities for the last three months of this year than were used in the corresponding period of 1926, according to reports received by the Car Service Division of the A. R. A. from the 13 shippers' regional advisory boards.

Dan and Asa Joslin, brothers, who are bridge and building supervisors on the Nashville, Chattanooga & St. Louis, were among 59 employees of that road who recently received service buttons emblematic of 50 years' service. Buttons are awarded for each five-year period of service, beginning with 10 years, and have different devices to typify the number of years served.

Evergreen hedges and trees as a substitute for snow and sand fences are being used on the Canadian Pacific which now has approximately 110 miles of such hedge on its Eastern lines, as the result of a policy inaugurated in 1916. The cost of planting and caring for the trees is said to be less than the cost of fences, and aside from furnishing protection from drifting snow the hedges also add to the appearance of the right-of-way.

The increase in the use of automatic flashing light signals at highway grade crossings with railroads in the state of New York is indicated by the number of such installations for which the plans have been approved by the Public Service Commission of that state. On September 27, 15 such approvals were issued; 11 for crossings on the New York, Ontario & Western; 2 on the New York Central and 1 each on the Pennsylvania and the Erie.

Frank Halpin, section foreman on the Michigan Central at Jackson, Mich., was one of 15 employees of the New York Central System who were awarded medals for acts of heroism in railroad service during 1926, which involved danger of physical injury or possible loss of life in performing meritorious acts. Foreman Halpin saved the life of one of his Mexican laborers who, misunderstanding what was to be done with a rail which was being lifted, placed his head under the rail as the signal was given to drop it. Foreman Halpin grabbed the rail and checked its fall sufficiently to allow the laborer to escape injury, but was himself so badly strained that he was unable to work for 41 days. The presentation of the medals was made by President P. E. Crowley in New York on October 5. The medals are of bronze, 1½ in. in diameter, and a lapel button of the same design was presented with each medal.

All of the railways of the state of New York were represented at the conference at Albany on October 10, which was called by Governor Alfred E. Smith to consider grade crossing problems, most of the important lines being represented by their presidents and other leading officers. The elimination of 276 grade crossings within the next 15 months was substantially agreed upon, of which 202 are outside the limits of the city of New York. The cost of the program for these crossings aggregates upward of $33,000,000.

Revenue freight car loadings for the week ending October 15 totaled 1,119,872, a decrease of 82,908 cars as compared with the corresponding week of last year, but an increase of 19,320 cars over the preceding week of the current year. As compared with 1926, all commodities showed decreases except livestock, which showed an increase of 25 cars. The cumulative totals for the first 42 weeks of the current year were 42,218,318 as compared with 42,691,897 and 41,218,272 for the corresponding periods in 1926 and 1925, respectively.

The St. Louis & O'Fallon and the Manufacturers' Railway were denied the right of a complete court review of the federal valuation of their properties through the introduction of new evidence, by a decison of the federal court at Kansas City, Mo., on October 6. The application for a permanent injunction to restrain the Interstate Commerce Commission from enforcing its order of March 31 for the recapture of excess earnings was taken under advisement and it is expected that the court's decision will be rendered before December 10, to which time the commission has postponed the effective date of its recapture order.

The increased operating efficiency of the country's railways is illustrated by the statistics showing the results of operation in July, which were published recently by the Interstate Commerce Commission. The average speed of freight trains in that month reached 12.6 miles per hour, surpassing all previous records, and the number of tons hauled one mile per average train in each hour also reached a new high mark of 9,853 as compared with the previous record of 9,840 ton-miles per hour, which was made in August, 1926. These achievements were made in the face of a reduction of eight per cent in freight business as compared with the same month in 1926.

A manual on the use of wood is being prepared by the National Committee on Wood Utilization, which was organized under the auspices of the United States Department of Commerce for the purpose of effecting greater economy in the use of the forest resources of the nation. The committee, which is under the direction of Axel H. Oxholm, director, and Dudley F. Holtman, assistant director, is being assisted by a committee of engineers and structural experts in a complete and authoritative compilation of the principles of engineering and good practice as applied to wood construction. The committee is also soliciting the co-operation of engineers and architects in offering suggestions and information having a bearing on structural design in various fields.

Personal Mention

General

T. W. Saul, track supervisor on the Chicago Great Western, with headquarters at St. Joseph, Mo., has been promoted to trainmaster on the Northern division, with headquarters at St. Paul, Minn.

H. A. Israel, division engineer of the Illinois division of the Missouri Pacific, with headquarters at Bush, Ill., has been promoted to trainmaster on the Chester and Cairo districts of that division, with headquarters at Dupo, Ill.

J. E. Gibault, whose railway training was in the engineering field, has been appointed superintendent of the Levis division of the Canadian National, with headquarters at Levis, Que. Mr. Gibault was born in 1887 at St. Jerome, Que., and graduated from the Polytechnical school at Montreal in 1910. He entered railway service on the Transcontinental (now a part of the Canadian National) where he had charge of construction work, later serving as division engineer at Cochrane, Ont., St. Maurice, Que., and Levis. In 1923, when the Bureau of Economics was established on the Canadian National, Mr. Gibault was appointed to a technical position in that department. During the past two years he has been in charge of the railway course at the Polytechnical school at Montreal.

J. E. Gibault

Harry R. Duncan, whose promotion to superintendent of timber preservation of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill., was noted in the October issue, was born on June 14, 1890, at Willard, Ohio. He entered railway service in September, 1908, as a clerk on the Baltimore & Ohio and a year later became a clerk in the store department of the Burlington at Aurora, Ill. He was transferred to the office of the general storekeeper at Chicago in August, 1911, and was promoted to chief clerk to the division storekeeper at Galesburg in April, 1915. Mr. Duncan was transferred to the office of the division storekeeper at Aurora in February, 1916, and a year later was promoted to general foreman in the store department at Havelock, Neb., remaining in that position until March, 1918, when he was further promoted to division storekeeper at Plattsmouth. In September, 1920, he was made general piece work inspector on the staff of the general storekeeper, with headquarters at Chicago, and was promoted to inspector of stores, with headquarters at the same place, in May, 1922. Mr. Duncan was promoted to traveling storekeeper on the staff of the general storekeeper in 1926, which position he was holding at the time of his recent promotion to superintendent of timber preservation.

Harry R. Duncan

W. H. Hillis, district engineer maintenance of way of the Illinois district of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill., has been promoted to assistant superintendent of the La Crosse division, with headquarters at La Crosse, Wis.

H. C. Murphy, transportation assistant on the Chicago, Burlington & Quincy, Lines West of the Missouri River, and formerly engineer maintenance of way of that portion of the system, has been assigned to the staff of the general manager of Lines East of the Missouri River to handle special matters.

Engineering

R. A. Thompson, Jr., has been appointed chief engineer of the Wichita Falls & Southern, with headquarters at Wichita Falls, Tex.

C. W. Shallenberger, supervisor on the Allegheny division of the Pennsylvania, with headquarters at Kittaning, Pa., has been promoted to assistant to the division engineer of the Erie and Ashtabula division, with headquarters at New Castle, Pa., a newly created position.

G. S. Smith, assistant engineer on the Missouri Pacific, with headquarters at Coffeyville, Kan., has been promoted to division engineer of the Illinois division, with headquarters at Bush, Ill., succeeding **H. A. Israel,** whose promotion to trainmaster is noted elsewhere in this issue.

R. L. Sims, engineer maintenance of way on the Chicago, Burlington & Quincy, Lines West of the Missouri River, with headquarters at Lincoln, Neb., has been transferred to Alliance, Neb. **A. Chinn,** engineer maintenance of way, with headquarters at Alliance, has been transferred to Lincoln, where he will have charge of work equipment.

D. C. Barrett, acting division engineer on the Minnesota division of the Chicago & North Western, with headquarters at Winona, Minn., has been promoted to division engineer, with the same headquarters, to succeed **T. J. Irving,** notice of whose death will be found elsewhere in this issue. A sketch of Mr. Barrett's career was published in the October issue.

F. M. Graham, whose promotion to engineer maintenance of way of the Lake division of the Pennsylvania, with headquarters at Cleveland, Ohio, was noted in the October issue, was born on January 29, 1872, at Nelson, Ohio, and was educated at the Case School of Applied Science. He entered railway service with the Pennsylvania in 1895 and from 1897 to 1903 was in various positions in the engineering department of that road, being promoted to division engineer in the latter year. In 1918 he was promoted to supervising engineer, with headquarters at Columbus, and in 1920 was further promoted to engineer maintenance of way of the Central Ohio division, with headquarters at the same place. In 1924, when the Central Ohio division was abolished, Mr. Graham resumed his former position as division engineer at Columbus, which position he was holding at the time of his recent promotion to engineer maintenance of way of the Lake division.

James C. Poffenberger, whose promotion to division engineer on the Pennsylvania, with headquarters at Pittsburgh, Pa., was noted in the October issue, was born on April 10, 1888, at Harrisburg, Pa. After graduating from Lehigh University in 1911, Mr. Poffenberger entered the service of the Pennsylvania on August 17, 1911, as a rodman on the East Pennsylvania division. On October 20, 1915, he was promoted to transitman and on September 28, 1916, he became assistant supervisor on the Trenton division, which position he held until April 1, 1918, when he was transferred to the Monongahela division. On September 15, 1918, he was transferred to the Middle division, and retained this position until October 16, 1921, when he was

promoted to supervisor on the Cresson division. From May 1, 1922, to May 7, 1927, he served as supervisor on the Philadelphia division, and on the latter date was transferred to the Philadelphia Terminal division as supervisor, which position he held until his recent promotion to division engineer.

Theodore A. Pattison, whose promotion to assistant division engineer on the Chesapeake & Ohio, with headquarters at Chillicothe, Ohio, was noted in the October issue, was born on July 18, 1888, at Trappe, Md., and was educated at Washington College and the Virginia Military Institute. He entered railway service in September, 1910, as a rodman on the Baltimore & Ohio and served successively as assistant foreman, levelman and transit man until October, 1912, when he became a draftsman with the Tennessee Coal, Iron & Railroad Company. In July, 1913, he became a building inspector on the Southern and in September re-entered the service of the B. & O. as an assistant supervisor of track where, by successive promotions he was made assistant division engineer. In 1917 Mr. Pattison entered the U. S. Army, returning to the B. & O. in January, 1919, as supervisor of track, being promoted to division engineer in July of the same year. He was out of railway service from April, 1920, until October, 1926, when he entered the employ of the C. & O. as a resident engineer, which position he was holding at the time of his recent promotion to assistant division engineer.

Louis P. Struble, whose promotion to assistant to the chief engineer of the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., was noted in the October issue, was born at Branchville, N. J., and was educated at Lehigh University, where he graduated in 1909. Mr. Struble entered railway service in November of the same year as a draftsman on the Pennsylvania and while acting in this capacity also had charge of construction work. In March, 1915, he was promoted to chief draftsman and remained in that position until June, 1919, when he was further promoted to assistant engineer, with headquarters at Pittsburgh, which position he was holding at the time of his promotion to assistant to the chief engineer of the Central region.

Louis P. Struble

Changes on the New York Central

John V. Neubert, engineer maintenance of way of the New York Central, Lines Buffalo and East, exterior zone, with headquarters at New York, has been promoted to chief engineer maintenance of way of the New York Central, Lines East and West and the Ohio Central Lines, with headquarters at the same place, a newly created position. **W. A. Murray,** engineer of track of the New York Central, Lines Buffalo and East, exterior zone, with headquarters at New York, has been promoted to engineer maintenance of way of the same territory to succeed Mr. Neubert, and **G. N. Edmonson,** division engineer at Albany, N. Y., has been promoted to engineer of track to succeed Mr. Murray. **J. N. Grim,** supervisor of track, with headquarters at Remsen, N. Y., has been promoted to division engineer of the Adirondack and Ottawa divisions, with headquarters at Utica, N. Y., where he replaces **S. A. Seely,** who has been transferred to the Pennsylvania division, with headquarters at Jersey Shore, Pa., succeeding **A. R. Jones,** who has been transferred to the Mohawk division, with headquarters at Albany, N. Y., to succeed Mr. Edmonson. **J. H. Kelly,** supervisor of track, with headquarters at Clearfield, Pa., has been promoted to division engineer of the Rochester division, with headquarters at Rochester, N. Y., to succeed **J. W. Stevens,** who has been transferred to the River division, with headquarters at Weehauken, N. J., where he replaces **S. E. Armstrong,** who has been promoted to engineer of standards, with headquarters at New York, a newly created position.

Mr. Neubert was born at Kittaning, Pa., and was educated at Pennsylvania State College, where he graduated in 1899. He entered railway service in the same year as a clerk on the New York Central & Hudson River (now a part of the New York Central) and later served as a chainman, rodman and inspector in the engineering department. On September 1, 1900, he was promoted to assistant supervisor of track, and in May, 1902, was further promoted to supervisor of track. On January 1, 1903, Mr. Neubert was made assistant engineer in the division engineer's office, serving in this capacity until April 1, 1907, when he was promoted to division engineer at Albany, N. Y. He was promoted to engineer of track, Lines East of Buffalo, exterior zone, in April, 1909, and this was followed in July, 1920, by his advancement to engineer maintenance of way of the same territory, with headquarters at New York, which position he was holding at the time of his recent promotion to chief engineer maintenance of way of Lines East and West and the Ohio Central Lines.

John V. Neubert

Mr. Murray was born on June 5, 1876, at Montville, Me. He graduated from the University of Maine in 1899 and entered railway service in the following year in the maintenance of way department of the New York Central at Buffalo, N. Y., remaining at this point in various capacities until December, 1905, with the exception of two years with the supervisor of bridges at Rochester, N. Y. He was promoted to assistant engineer at Albany in December, 1905, and was transferred to the office of the engineer maintenance of way at New York in the following year. He was appointed supervisor of track, with headquarters at Richland, N. Y., in November, 1907, and later was transferred to Canandaigua. In April, 1909, he was promoted to division engineer, with headquarters at Rochester, N. Y., being transferred successively to Jersey Shore, Pa., and Albany, N. Y. He was promoted to engineer of track in July, 1920, which position he was holding at the time of his recent promotion to engineer maintenance of way, Buffalo and East.

Mr. Edmonson was born on August 22, 1879, at New Haven, Conn., and after graduating from Yale University in 1901 entered the service of the New York Central on July 8, 1901, serving as a chainman, rodman and assistant supervisor on the Eastern division until 1903, when he was made assistant supervisor and acting supervisor of track at Peekskill, N. Y. In 1905 he was promoted to assistant engineer of track, with headquarters at New York City, and in 1907, was made supervisor of track at West Albany, N. Y., which position he held until 1910, when he was promoted to assistant division engineer at Utica, N. Y. Mr. Edmondson was promoted to division engineer at Rochester, N. Y., in 1911, was transferred to Jersey Shore, Pa., in 1918, and was again transferred to Albany, N. Y., in 1920, where he was located at the time of his recent promotion to engineer of track.

Mr. Grim was born on June 7, 1892, at Newton Square, Pa., and after graduating from the University of Pennsyl-

vania in 1914, entered the service of the New York Central at Albany, N. Y., as a chainman. In 1916 he was made bridge inspector and assistant supervisor of bridges at Utica, N. Y., and served in this capacity until 1921, when he was made assistant supervisor of track at West Albany, N. Y. In 1925 he was promoted to assistant division engineer at Utica and in the early part of 1927 was appointed supervisor of track at Remsen, N. Y., which position he held until his recent promotion to division engineer.

Mr. Kelly was born on August 9, 1891, at Fonda, N. Y., and received his engineering education at Rensselaer Polytechnic Institute, Troy, N. Y. He entered railway service in the enginering corps of the division engineer of the New York Central at Albany, N. Y., in August, 1912. In 1913 he was promoted to engineering assistant on sub-division 6, between Schenectady, N. Y., and Herkimer, where he remained until August 24, 1917, when he obtained a leave of absence to enter the United States Army, later sailing for France as a lieutenant of artillery on January 10, 1918. Following active participation in the various drives of the American Expeditionary Forces and receiving several decorations and citations he returned to this country on September 3, 1919, resuming his position as engineering assistant on October 12 of the same year. In 1923 he was promoted to assistant division engineer at Utica, N. Y., and served in this capacity until June 1, 1925, when he was made supervisor of track on the Pennsylvania division, with headquarters at Clearfield, Pa. Mr. Kelly held this latter position until October 1, 1927, when he was appointed division engineer of the Rochester division at Rochester, N. Y.

Track

W. White, section foreman in the yard of Calgary, Alta., has been promoted to acting roadmaster on the Calgary division, with headquarters at Rocky Mountain House, Alta., to succeed **A. Daem,** who has been transferred to Hanna, Alta.

F. Larson, roadmaster on the Chicago, Milwaukee & St. Paul, with headquarters at Wabasha, Minn., has been transferred to the I. & M. division, with headquarters at Farmington, Minn., to succeed **H. K. Krohn,** who has been assigned to other duties.

R. H. Carter, assistant engineer on the Chicago terminals of the Illinois Central, has been promoted to supervisor, with headquarters at Kankakee, to succeed **George W. Shrider,** notice of whose death on September 17 was published in the October issue.

John Gaynor, section foreman on the Michigan Central, has been promoted to roadmaster, with headquarters at Welland, Ont., with jurisdiction over the district from Welland to Tillsonburg, succeeding **B. Taylor,** who was transferred to the territory from Welland to Niagara Falls and Bridgeburg, including the Niagara branch, with the same headquarters, replacing **C. Durham,** whose retirement was noted in the October issue.

George Iverson, section foreman on the Nebraska division of the Union Pacific, has been promoted to acting general roadmaster of the Central division, with headquarters at Marysville, Kan., in the place of **R. S. Reed,** who is on leave of absence on account of sickness. **O. W. Swanson,** section foreman on the Central division, has been promoted to acting district roadmaster, with headquarters at Marysville, to succeed **J. Gordon,** resigned.

F. G. Church, assistant supervisor on the Eastern division of the Pennsylvania, with headquarters at Freedom, Pa., has been promoted to supervisor on the Wheeling division, with headquarters at Steubenville, Ohio, to succeed **A. E. Swain,** who has been assigned to other duties. **L. C. Martoia,** general foreman, has been promoted to assistant supervisor on the Conemaugh division, with headquarters at Verona, Pa., replacing **O. Downes,** who has been transferred to the Eastern division, with headquarters at Freedom, Pa., to succeed Mr. Church. **C. H. Frick,** supervisor on the Allegheny division, with headquarters at Du Bois, Pa., has been transferred to Kittaning, Pa., on the same division to succeed **C. W. Shallenberger,** whose promotion to assistant to the division engineer of the Erie and Ashtabula division is noted elsewhere in this issue.

J. P. McKinney, whose promotion to supervisor on the Richmond division of the Pennsylvania, with headquarters at Richmond, Ind., was noted in the October issue, was born on June 22, 1891, in Jackson County, Ind. He entered railway service on February 2, 1913, as a trackman on the Louisville division of the Pennsylvania and was promoted to extra track foreman on October 10, 1917, with headquarters at Columbus, Ind. He was further promoted to track foreman on August 1, 1920, and to extra gang foreman on May 15, 1922, since which time he served alternately as track foreman and extra gang foreman until his recent promotion to supervisor.

Russell M. Kelly, assistant division engineer of the Ontario division of the New York Central, with headquarters at Oswego, N. Y., has been appointed supervisor at Clearfield, Pa., to succeed **J. H. Kelly,** whose promotion to division engineer of the Rochester division is noted elsewhere in this issue, and **George Baerthlein,** assistant division engineer of the Eastern division, with headquarters at New York, has been appointed supervisor at Remsen, N. Y., replacing **J. N. Grim,** who has been promoted to division engineer of the Adirondack and Ottawa divisions, as noted elsewhere in the current issue.

Mr. Kelly was born on June 21, 1891, at Sanborn, Ia., and after graduating from Dartmouth College in June, 1915, he entered the service of the New York Central, holding various positions in the engineering corps on the Pennsylvania and the Mohawk divisions until January 1, 1917, when he was made bridge inspector, with headquarters at Utica, N. Y. On September 28, 1917, he entered the United States Army and on July 18, 1919, re-entered the service of the N. Y. C. as a bridge inspector. He held this position until July 16, 1920, when he was promoted to assistant supervisor of bridges at Utica. From October 1, 1920, to February 1, 1923, he served as assistant supervisor of track at Malone, N. Y., and on the latter date was transferred to Lackawanna, N. Y., where he served until December 1, 1925, when he was promoted to assistant division engineer at Oswego, the position he was holding at the time of his recent appointment as supervisor of track.

Mr. Baerthlein was born on May 27, 1880, at Guttenberg, N. J., and received a degree in civil engineering at Cooper Union, New York City, in 1910. He entered the service of the New York Central on September 17, 1907, serving respectively as chainman, rodman, transitman and draftsman in the office of the division engineer at Weehawken, N. J., and in May, 1912, was promoted to assistant chief draftsman in the office of the engineer maintenance of way at New York. From July, 1916, to April, 1923, he served as assistant supervisor of track at Pawling, N. Y., and on the latter date became assistant engineer of track in the office of the engineer maintenance of way at New York. In December, 1925, he was made assistant division engineer, and was holding this position at the time of his recent appointment to supervisor of track.

Bridges and Buildings

O. E. Blake, of the bridge and building department of the Chicago, Milwaukee & St. Paul, has been promoted to chief carpenter, with headquarters at Mobridge, S. D., to succeed **Asa Berfield,** notice of whose death will be found elsewhere in this issue.

Purchasing and Stores

M. E. Baillie, division storekeeper on the Missouri Pacific, with headquarters at Kansas City, Mo., has been promoted to district storekeeper at St. Louis, Mo., succeeding **E. A. Porter,** who has been appointed division storekeeper to take the place of **W. R. Caldwell,** at Monroe, La., who has been transferred to Kansas City to succeed Mr. Baillie.

G. A. Goener, storekeeper on the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., has been promoted to traveling storekeeper, with headquarters in the

same city, to succeed **H. R. Duncan**, whose promotion to superintendent of timber preservation was noted in the October issue. **John Maier**, storekeeper at Galesburg, Ill., has been transferred to Aurora to succeed Mr. Goerner, and **R. E. Kelly**, storekeeper at West Burlington, Iowa, has been transferred to Galesburg to replace Mr. Maier. **A. G. Swanson**, general piece work inspector, with headquarters at Chicago, has been appointed storekeeper at West Burlington, succeeding Mr. Kelly. **J. K. McCann**, storekeeper, with headquarters at St. Joseph, Mo., has been appointed general piece work inspector, with headquarters at Chicago, to succeed Mr. Swanson, and **R. H. Johnson** has been appointed storekeeper at Alliance, Neb., to succeed **J. H. Schwartz**, who has been transferred to St. Joseph, Mo., to take the place of Mr. McCann.

Obituary

Asa Berfield, chief carpenter on the Chicago, Milwaukee & St. Paul, with headquarters at Mobridge, S. D., was killed in a motor car accident on August 3.

Anthony Wayne Davis, formerly supervisor of buildings on the New York Central, with headquarters at Elkhart, Ind., who retired on March 1, 1926, died on July 26.

Charles Yoder, engineer maintenance of way of the New York Central, Lines West of Buffalo, notice of whose death on September 28 was published in the October issue, was born on November 24, 1873, at Madisonburg, Ohio. Mr. Yoder attended Mt. Union College at Alliance, Ohio, from 1888 to 1891 and entered railway service in 1892 as a rodman on the Lake Shore & Michigan Southern (now a part of the New York Central). He was promoted to levelman in the following year and later, from 1896 to 1898, served as a clerk in the office of the roadmaster. On April 28, 1898, Mr. Yoder enlisted in the army for the period of the Spanish-American war, returning to the Lake Shore as a roadmaster in July, 1899. He was a roadmaster on the Lake Erie & Western from March, 1901, to January, 1903, returning to the Lake Shore in the same capacity. He was promoted to engineer of track of the Lake Shore in June, 1905, remaining in this position on that road and its successor, the New York Central, until June, 1924, when he was promoted to engineer maintenance of way of the lines West of Buffalo, which position he was holding at the time of his death.

T. J. Irving, division engineer of the Chicago & North Western, with headquarters at Winona, Minn., who was granted a leave of absence in August on account of ill-health, died in a hospital at Rochester, Minn., on September 22. Mr. Irving was born on June 4, 1880, at Clyman, Wis., and was educated at the University of Wisconsin, where he graduated in 1905. He entered railway service in the same year as a rodman on location and construction on the Chicago & North Western in Wisconsin, later serving as a rodman and instrumentman until January 1, 1908, when he became an instrumentman on maintenance in Chicago. In June, 1909, he was promoted to assistant engineer and was engaged in location, construction, maintenance and valuation work until October 1, 1919, when he was further promoted to division engineer and supervisor of bridges and buildings on the Southern Illinois division, with headquarters at South Pekin, Ill. On March 1, 1920, he was transferred to the West Iowa division, with headquarters at Boone, Iowa, and on June 1, 1921, as a result of the consolidation of the East Iowa and the West Iowa divisions, he was appointed assistant division engineer of the Iowa division, with headquarters at the same place. Mr. Irving was promoted to division engineer of the Minnesota division, with headquarters at Winona, Minn., in March, 1922, which position he was holding at the time of his death.

A Record of Safety—The passenger ferries of the Southern Pacific on San Francisco Bay carry 39,560 life preserves which are maintained in first-class condition at an expense of many thousands of dollars; but never in their career have these boats, 21 in number, lost a single life by accident.

Construction News

The Albany Port District Commission has applied to the Interstate Commerce Commission for authority for the construction of a 3-mile terminal railroad to connect the docks now under construction in the Albany port district with the tracks of the New York Central, Delaware & Hudson and West Shore.

The Atchison, Topeka & Santa Fe has authorized a general program of improvements at Streator, Ill., which will include the construction of a one-story brick and concrete passenger station, a freight station, a 500-ton steel coaling station, the rearrangement of water facilities and necessary track changes.

Bids closed on October 15 for the construction of a four-story reinforced concrete and steel combined recreation center and apprentice school building at Topeka, Kan., with outside dimensions of 80 ft. by 120 ft. Bids closed on the same date for the construction of a reinforced concrete and steel structure to house the Santa Fe fire department at Topeka. This building will be two stories in height and will have outside dimensions of 50 ft. by 100 ft.

The Baltimore & Ohio has awarded a contract for the construction of water treating plants at Hamler, Ohio, and Kellar, to the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa. A contract has also been let to the same company for the construction of water treating plants at New Castle and New Castle Junction, Pa., which will cost $6,000 and $10,000 respectively.

The Canadian National has prepared plans for the construction of a 30-stall brick and steel roundhouse, with machine ship and accompanying yard facilities at Tecumseh, Ont., at an estimated cost of $1,000,000. A contract for the construction of a 100-ton mechanical coaling station at Moose Jaw, Sask., has been let to the Bennet & White Construction Company, Calgary, Alta. A contract for the construction of a mechanical coaling station of similar capacity at Camrose, Alta., has been let to H. G. Macdonald & Co., Edmonton, Alta.

An order-in-council has been issued by the Canadian government authorizing the Canadian National to expropriate lands necessary for the construction of a new passenger terminal in Montreal. The road now has two main stations in the city, i. e., Bonaventure and La Gauchtière, of which the former is, in volume of traffic handled, by far the more important. The latter is familiarly known as the "Tunnel Terminal" and is located at the end of the former Canadian Northern's electrified tunnel under Mount Royal. Bonaventure station, which handles the bulk of C. N. R. Montreal business, is an old structure and is reached by lines which have many highway crossings at grade. The company's plans, about which nothing specific has yet been made public, contemplate, apparently, the abandonment of Bonaventure altogether and the development of a large new station at the present site of the Tunnel Terminal.

The Chicago, Rock Island & Pacific has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of a one-story brick passenger station with outside dimensions of 24 ft. by 83 ft., at Sayre, Okla.

This company plans the construction of a water station with a 50,000-gal. conical bottom steel tank at Lincoln, Neb. Authorization has also been given for the construction of 15-ft. extension to nine stalls of the roundhouse at Trenton, Mo.

Application has been made to the Interstate Commerce Commisison for authority to build an extension of about 10 miles south from Bowlegs, Okla.

The Detroit & Ironton has been granted a further extension of time to December 31, 1929, for the completion of the line from Malinta, Ohio, to Durban, Mich., under the certificate issued by the Interstate Commerce Commission on August 1, 1924. The company had asked for an extension to 1931.

The Grand Trunk Western has awarded a contract to W. E. Lennane for the construction of a grade separation structure at Joseph Campau avenue, Hamtramck, Mich. The cost of this project is estimated at $230,000, while improvement to track facilities coincident with this construction are expected to make the total cost $340,000.

The Detroit, Grand Haven & Milwaukee, the Pontiac, Oxford & Northern and the Michigan Air Line, subsidiaries of this company, have filed with the Interstate Commerce Commission a joint application for a certificate authorizing the construction of a terminal transfer or belt line of 6.63 miles, connecting their existing lines at Pontiac, Mich.

The Great Northern has authorized the construction of a shop for the repair of electric locomotives at Appleyard, Wash. The building, which will be of brick and steel construction and will have outside dimensions of 82 ft. by 204 ft., will be served by four tracks with one drop pit and two traveling cranes of seven and one-half tons and 35 tons capacity respectively. Complete cost of the shop is estimated at $95,000. A contract has been let to George H. Moon, Bellingham, Wash., for the construction of a passenger station at Bellingham, to cost about $50,000. A contract for the paving of an area in the vicinity of the Spokane, Wash., freight station has been let to Charles A. Power, Spokane. Along with the reconstruction of platforms and rearrangement of tracks, the expenditure at this point is expected to approximate $60,000. A contract for the construction of a passenger station at Whitefish, Mont., has been let to the T. B. Butler Construction Company, Seattle, Wash., at a cost of about $60,000.

A contract has been let to E. J. Dunnigan, St. Paul, Min., for the construction of water treating plants at 24 points on its lines in western Dakota and eastern Montana at an estimated cost of $300,000.

The Long Island's grade crossing elimination program, planned for various points on its line to last through several years until 1931, has been set ahead and, according to plans now being considered, about 25 crossings will be eliminated within the coming year.

The Michigan Central and the city of Detroit have prepared plans for the depression of tracks and the elevation of a street, involving the construction of a steel and concrete highway bridge, at Joseph Campau avenue, Detroit, as part of the general program of grade separation in that city.

The Missouri & North Arkansas has prepared plans for the reconstruction of a 300-ft. draw span in the bridge over the White river near Georgetown, Ark.

The Missouri Pacific has awarded contracts to Fairbanks, Morse & Co., Chicago, for the construction of a 400-ton reinforced concrete mechanical operated coaling station at Gurdon, Ark. A contract has also been let to the Roberts and Schaefer Company, Chicago, for the construction of a reinforced concrete two-track coaling station of 140-ton capacity at Jefferson City, Mo.

The New York Central has awarded a contract to the M. A. Long Company, Baltimore, for the furnishing and installing of wheat cleaning machinery in its grain elevator at Weehawken, N. J.

A contract has been let to Edward J. Duffy Company, Inc., of Weehawken, N. J., for the construction of a platform, canopies and driveways, together with drainage, between 140th and West 146th streets, New York, and another contract has been let to Wright & Kremers, Inc., of Niagara Falls, N. Y., for the construction of a freight house, canopies and platforms at North Tonawanda, N. Y.

Plans are being considered by this road for extending its four-track line from Manitou, N. Y., a distance of about 10 miles, to Beacon, all in Putnam county, New York.

The Northern California has applied to the Interstate Commerce Commission for authority to build a line of 31 miles from Westwood, Cal., south to the line of the Indian Valley, which connects with the Western Pacific at Paxton, thus forming a shorter route to Sacramento. It is proposed to acquire part of the line from the Red River Lumber Company. Willis J. Walker, San Francisco, Cal., is president.

The Pennsylvania has awarded a contract to the Mellon Construction Company of Chicago for the laying of track on a change of line from Collinsville to St. Jacob, Ill., at a cost of $100,000. The Tunstall-Johnson Company, of Norfolk, Va., has been awarded a contract for grading and track work from North Junction to Camden Heights and for the Julian avenue and Little Creek yards in connection with the Little Creek improvements at Norfolk, Va., at a cost of $300,000.

The construction of a cold storage warehouse, with the necessary auxiliary equipment, has been authorized at the new produce terminal in Philadelphia. The building will be eight stories high and will have a net cold storage capacity of 2,000,000 cu. ft.

The Pere Marquette has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from Wixom to Pontiac, Mich., 17.4 miles, and a belt line around the northerly and easterly sides of the city of Pontiac, approximately 7 miles, connecting with it, as "part of a general plan to construct a line of railroad forming a cut-off from Grand Junction to Woodbury," 63 miles, and an extension from Green Oak to Lenox, 57 miles, to be constructed at some future date.

The St. Louis-San Francisco has awarded a contract to Will F. Pauly, for the construction of a one-story brick combined passenger and freight station at Columbus, Miss., and for the construction of a station of similar type at Demopolis, Ala. The cost of construction of the two stations is estimated at $125,000. The outside dimensions of each building will be 35 ft. by 226 ft. Included in each project is a brick and reinforced concrete platform 226 ft. long.

A contract for the construction of a 50-ton steel electrically operated coaling station at Memphis, Tenn., has been let to the Ogle Construction Company, Chicago.

The Seaboard Air Line has let a contract to the C. V. York Company of Raleigh, N. C., for the construction of a new passenger station at Arcadia, Fla., which will be a hollow tile and stucco building of Spanish architecture. In addition to the usual waiting rooms, office, and baggage room, there will be an open loggia 20 ft. by 34 ft., 210 lin. ft. of butterfly shed, passenger landings, and driveway.

The Tennessee Central has ordered a junior "N. W." type electrically operated cinder conveyor to be installed by company forces at Monterey, Tenn., from the Roberts & Schaefer Company, Chicago. This project will include the construction of two inspection pits.

The Texas & Pacific has awarded a contract to the Austin Brothers Construction Company, Austin, Tex., for the construction of a steel shop building at Big Spring, Tex., to replace a building destroyed by fire. Outside dimensions of the shop will be 42 ft. by 146 ft. with an addition of 14 ft. by 62 ft.

The Texas Terminal is preparing plans for the reconstruction of a warehouse and dock recently destroyed by fire at Texas City, Tex. The cost of this work is estimated at $200,000.

The Union Pacific has awarded a contract for the construction of a reinforced concrete viaduct across the Industrial District Yards, including tracks of this company and the Atchison, Topeka & Santa Fe at First street, Los Angeles, Cal., to the North Pacific Construction Company.

The Western Pacific has presented to the Idaho Public Utilities Commission plans for the construction of a connection between the Western Pacific and the Union Pacific at Wells, Nev., about 6,000 ft. in length. Included in this project, which is expected to involve a total expenditure of $160,000, is the separation of the grades of two highways by the construction of subways at the point where the new line of the Western Pacific would cross the Southern Pacific. The crossing of the Southern Pacific would be effected by means of a 120-ft. overhead steel span.

Supply Trade News

General

The Robert W. Hunt Company has removed its office at Birmingham, Ala., from the Alabama Power & Light building to the Bankers Bond building.

The American Manganese Steel Company, Chicago, has purchased the foundry of the American Brake Shoe & Foundry Company, at Burnside, Ill., and will begin operation of it on January 1.

The Marion Steam Shovel Company, Marion, Ohio, has established direct factory branches at Seattle, Wash., and Portland, Ore., with **C. H. Allen** in charge of the former and **H. L. Niles** in charge of the latter branch.

The Alexander Milburn Company, Baltimore, Md., has opened an office under the name of the **Alexander Milburn Sales Company** at 50 Terminal street, Boston, Mass., to handle the sale and distribution of its equipment in the New England states.

Charles M. Schwab, chairman of the board of the Bethlehem Steel Corporation, has been elected president of the **American Iron & Steel Institute** to succeed the late Elbert H. Gary; **James A. Farrell,** president of the United States Steel Corporation, has been elected vice-president of the Institute and **Eugene J. Buffington,** president of the Illinois Steel Company, has been elected a director.

J. F. Prettyman & Sons have recently put in operation a modern wood preserving plant at Charleston, S. C., which has been under construction since the latter part of January. This new plant, which covers an area of 48 acres, has a capacity for treating from 55,000,000 to 100,000,000 ft. b. m. of timber annually and provides space for the storage of over 1,000,000 ties in addition to a large area for the seasoning and storage of piles, poles and other timber. The plant is served by over 6½ miles of standard gage tracks and is equipped to handle all classes of timber framing. About November 15 it is expected that a new tie adzing and boring plant, now under construction, will be put in service.

Personal

A. H. Deimer, of the main office of the Buda Company, Harvey, Ill., has been transferred to the New York office as sales engineer, to succeed **N. C. Study,** who has resigned.

J. C. Fitzpatrick has been appointed district manager of sales of the Chicago Pneumatic Tool Company, Chicago, with headquarters at Cleveland, Ohio, succeeding **J. L. Westenhaver,** who has resigned to enter business for himself.

J. R. Matlack, treasurer of S. F. Bowser & Co., Ft. Wayne, Ind., has been appointed treasurer and general manager of S. F. Bowser & Co., Ltd., Toronto, Ont. **E. D. Eggiman,** secretary of S. F. Bowser & Co., has been appointed treasurer to succeed Mr. Matlack.

E. J. Stocking, secretary of the American Wood Preservers' Association, with headquarters at Chicago, has been appointed general sales manager of the Western Tie & Timber Company, and the Kettle River Treating Company, with headquarters at St. Louis, succeeding **R. A. Calvin,** resigned. Mr. Stocking will continue his duties as secretary of the wood preservers' association until January 1.

George Stanton, manager of sales of the Cleveland Frog & Crossing Company, Cleveland, Ohio, died on October 20 at his home in Cleveland. Mr. Stanton entered railway service about 40 years ago with the Grand Rapids & Indiana (now a part of the Pennsylvania). He afterwards became connected with the railway supply business, in which he was engaged for upwards of 35 years. He was associated with the U. S. Wind Engine and Pump Company, Batavia, Ill., for a considerable period and later was with the Q and C Company, Chicago, for nearly 10 years. In 1914, he became manager of sales of the Cleveland Frog & Crossing Company, continuing in that capacity until the time of his death.

Kurt C. Barth, director of the research division of the Western Red Cedar Association, died on October 9 at Evanston, Ill., after a short illness.

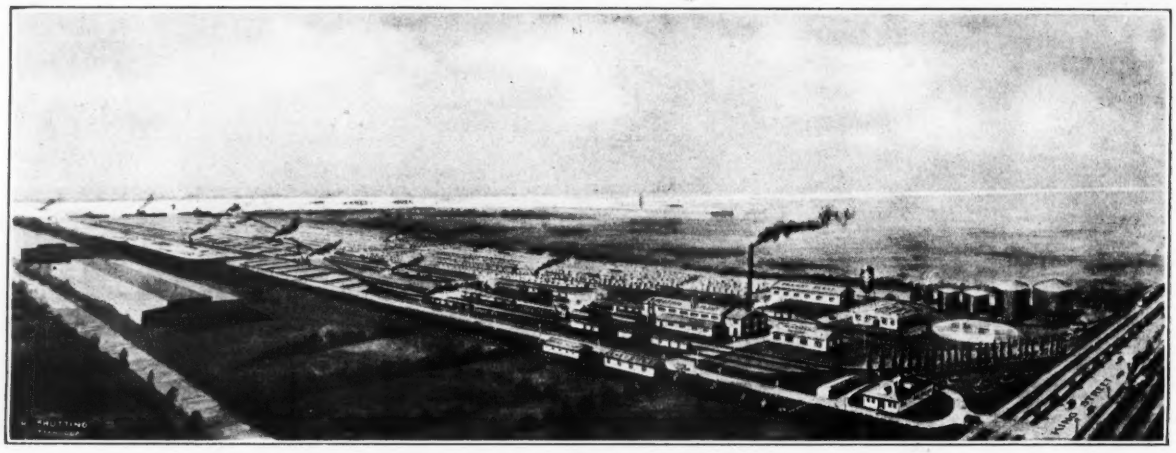
Arthur C. Smith, vice-president of the Morden Frog & Crossing Company, Chicago, died at Elmhurst, Ill., at the age of 56. Mr. Smith was born in London, England, in 1871 and came to this country in 1878. He was educated at Lewis Institute and after his graduation he entered railway service in the engineering department of the Illinois Central. He was later employed in the chief engineer's office of the Union Pacific, remaining there until 1900, when he resigned to become chief engineer of the Morden Frog & Crossing Company, with headquarters at Chicago. Mr. Smith held this position until 1904, when he was promoted to sales engineer. He was elected vice-president in 1908, which position he was holding at the time of his death.

Arthur C. Smith

Charles F. Quincy, chairman of the board of directors of the Q and C Company, New York, died on October 1 at his summer home at Center Harbor, N. H., after a prolonged illness. Mr. Quincy was born on July 16, 1856, at Newton, Mass., and was in the railway supply business since 1886, first with the Durham Company and later with the Q and C Company, becoming president of the latter concern in 1899. In 1906 the corporate title was changed to the Quincy-Manchester-Sargent Company, under which name the business was conducted until 1909, when the name Q and C Company was resumed. Mr. Quincy continued as president until 1924, when he became chairman of the board, which position he was holding at the time of his death. Mr. Quincy was also actively connected with several other enterprises.

Charles F. Quincy

The 1928 Model Casey Jones Section Car.—The Northwestern Motor Company, Eau Claire, Wis., has issued a 14-page bulletin describing the changes which have been made in the Casey Jones No. 521 car. In the new model the timer is placed on the outside of the flywheel, where it can be removed by removing the flywheel nut while the ignition switch is placed on the time lever bracket. A three-step drawbar is provided to permit coupling to other cars of different heights.



Bird's Eye View of Plant and Storage Yard

PRETTYMAN PRESERVED FOREST PRODUCTS NOW ON THE MARKET

Our large modern Shipley designed pressure treating plant was completed and began operating September 8th. We carry large stock piles, poles, ties and timbers, operate our own mills enabling us to make prompt shipment.

CREOSOTED

Railroad Cross-ties, Switch Ties, Bridge Timbers, Construction Timbers, Mine Timbers, Lumber, Piling, Poles, Posts, and other Forest Products.

Also manufacturers of Southern Yellow Pine, Cypress and Hardwoods. Owning 60,000 acres of timber land, insuring our source of supply of raw material.

EXCELLENT RAIL AND WATER SHIPPING FACILITIES

Your inquiries solicited; cost estimates cheerfully furnished. A trial order will convince you that the quality of our product and our service is unequalled.

Eastern Sales Agents

New England Wood Preserving Company, Inc.

Chamber of Commerce Building, Boston, Mass.

350 Madison Avenue, New York, N. Y.

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

HE KNOWS HOW TO HANDLE THEM

A JOHNS-MANVILLE salesman knows his products—and he is as willing to give a practical demonstration of them in the shop as he is to talk about them in the P. A.'s office.

Often you will find him in overalls chasing a dollar's worth of packing to its lair to find out how it may give better service to his customer. Or perhaps you will find him in an executive's office working out a plan of ordering that will simplify the routine of the supply department.

For he is a student of the economics of materials and his big idea is to save money. So you find him everywhere working with the users of his products on the common problem of getting the greatest amount of service at the least possible cost.

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
and other Johns-Manville Products

JOHNS-MANVILLE

SERVICE TO RAILROADS

JOHNS-MANVILLE CORPORATION, Madison Avenue at 41st Street, New York City
Branches in all large cities. For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Mud Is No Hindrance Here

Shifting track on a waste dump composed of soft, sticky, blue clay. An idea of the consistency of this material can be gained by the roll of clay at one side where it has been pushed by the spreader.

Working under adverse conditions

If you have ever tried to shift or raise track by hand, where a solid footing cannot be secured, you know what a job it is. Imagine trying to shift track in material of this kind. The two ties protruding from the ground at the right were placed under the footpiece to get a better footing, and even buried as they are a firm foundation could not be obtained.

The Track Machine is ideal for jobs like this as it will do them quicker and at a great saving over hand labor.

When equipped with leveling device, it will raise track vertically. For such work it is much faster than jacks for ballasting jobs. All machines can be equipped with hoist and boom, converting it into a machine for re-laying and handling steel. It is an all-purpose machine, one that should be found on every railroad division.

If you have track to raise, shift, ballast, steel to re-lay, material to stock-pile, maintain dumps, etc., write our Track Machine Department for Bulletin YE-8 and further particulars about this labor saving machine.

Nordberg Mfg. Co., Milwaukee, Wis.

THE NORDBERG PATENTED TRACK MACHINE

CHARLES M. SCHWAB

"Makers of Business Prosperity"

"BUSINESS journalism has established a great clearing house of information," says Mr. Schwab, probably as widely recognized for his human understanding of selling as for his capacity as a great manufacturer.

"You cannot have prosperity," says Mr. Schwab, "without confidence, and you cannot have confidence without a free and honest exchange of information."

* * * * *

That is the platform this publication stands on. Business publications which succeed are more than a collection of editorial and advertising pages.

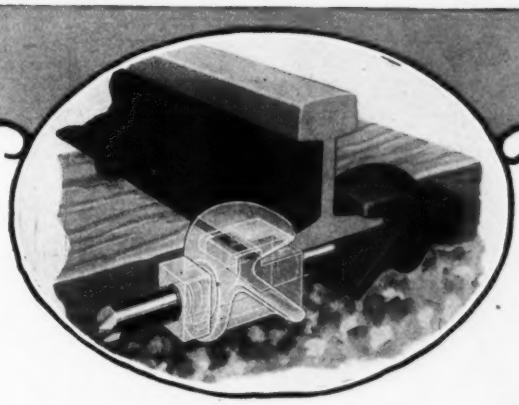
* * * * *

Every publication has its specialized field of service and plays its part intimately in the interchange of information and opinion, which is the basis of prosperity to which the captain of steel refers.

* * * * *

Both editorial and advertising pages are made to fulfill this great responsibility. The men and methods the editors select for their pages and the advertising which the clients of this paper buy to inform its readers of their products, are brought together between the covers of a business journal for intimate help and service.

When you have read both editorial and advertising sections and you have a complete knowledge of the service the publisher of this journal has prepared for you; then you, like Mr. Schwab, will see it—a Maker of Prosperity.



BRIDGE THE GAP — WITH COOVER BRACES —

A unit of the two rails is formed where Coover Braces are applied. The Vise Grip, singular to the Coover Unit, causes every part of the track to function differently.

As a unit rails can no longer spread—nor can they turn over. One rail is forced to carry the strain of the other. The pressure directed heretofore on the spike at point of wheel contact, is distributed equally to all spikes. The major rail and spike stresses are carried by the Coover Brace.

If rails can no longer spread—Crowding of outer spikes is eliminated. If they cannot tilt—there is no lifting of inner spikes. Respiking is therefore practically eliminated—Repeated abandoning of ties caused by respiking—is no longer necessitated.

The entire track construction is simplified and strengthened, thru the use of Coover Braces. The life of every part of the track is prolonged, labor is saved, and costly accidents and delays prevented.

The cut of the tie-less track below substantiates our claim that Coover Braces carry—The Major Rail Strain.

The Coover Railroad Track Brace Co.
Dayton, Ohio, U. S. A.

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering & Maintenance*, published monthly at Chicago, Ill., for October 1, 1927.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. V. Wright, who, having been duly sworn according to law, deposes and says that he is the Secretary of the Simmons-Boardman Publishing Co., publishers of *Railway Engineering & Maintenance* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above captain, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 W. Adams St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owner is:

Simmons-Boardman Publishing Co., New York, N. Y. Owners of 1 per cent or more of the total amount of capital stock are: Edward A. Simmons, New York, N. Y.; Henry Lee, New York, N. Y.; Cecil R. Mills, New York, N. Y.; George Slate, New York, N. Y.; Roy V. Wright, New York, N. Y.; Thomas Prosser & Son, New York, N. Y.; Herbert L. Aldrich, New York, N. Y.; Samuel O. Dunn, Chicago, Ill.; Carrie E. Dunn, Chicago, Ill.; Lucius B. Sherman, Chicago, Ill.; Elmer T. Howson, Chicago, Ill.; Frederick H. Thompson, Cleveland Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) There are none.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

R. V. WRIGHT,
Secretary.

Sworn to and subscribed before me this 28th day of September, 1927.

[SEAL] H. D. NELSON,
(My commission expires March 30, 1929.)

Classified Advertisements

Use this section when seeking a new man, a new position, or when buying or selling second-hand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide an insertion.

EMPLOYMENT ADVERTISEMENTS, 10 cents a word a month, minimum charge $2.00. Remittance must accompany each order.

RAILWAY ENGINEERING AND MAINTENANCE
Classified Department
608 South Dearborn Street, Chicago

Wanted representation to the railroad trade for a quality line of shovels and scoops which is nationally known. Address Box 273, Railway Engineering and Maintenance, 105 West Adams Street, Chicago, Ill.

Curve and Switch Work

MADE EASY FOR YOU

204 pages, 24 illustrations, pocket size, Price $2.00 Net, Postpaid.

How often have you stood there and pondered just how to go ahead with that curve problem? How often have you forgotten a rule for computing a switch dimension? Suppose just at that moment you put your hand to your side pocket and found in it a book (pocket-size) that answered every possible question *that can come up* in curve and switch work? That is the kind of book we are now asking you to examine. A book written by an expert—a man who discusses his subject in the light of 25 years' actual experience in maintenance work on a large eastern road. He knows from practical experience what you want, what information you need daily. All the information is in "Simplified Curve and Switch Work" and written in plain, everyday understandable English and in a simple, practical manner.

Short methods that save time by formula, by explanation and by illustration

This book is "chucked" full of short methods that not only save time but worry. Why worry? For a mere $2.00 you can have at your finger tips an answer to every problem. "Simplified Curve and Switch Work" simplifies your problem—The algebraic and geometric calculations are brought as nearly as possible to simple arithmetic. Step by step these calculations are explained in plain English. Finally by means of drawings and illustrations the whole subject is clarified.

See

SIMPLIFIED CURVE AND SWITCH WORK

By W. F. RENCH, formerly Supervisor on Pennsylvania Railroad

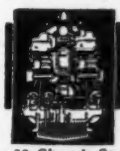
You are not asked to purchase this book before you have seen it and used it. Make use of our 10 day on approval offer. You obligate yourself in no way whatsoever by sending in this Free Examination Coupon. See the book. If you like it send us $2.00. If you do not,—return the book and that closes the matter.

Read over this table of contents. Don't you feel that any one of the sections is worth $2.00?

1. The Relining of Curves with a String.
2. Preliminary Study of the Curve.
3. The Solution of String Lining Problems.
4. Superelevation of Curves.
5. The Spiral.
6. The Vertical Curve.
7. Economics of Curves.
8. Essential Elements in the Design of Switch Connections.
9. Rules for Computing Switch Dimensions.
10. Rules for Various Functions of Turnouts.
11. Practical Considerations in Installing Turnouts.
12. Methods in Installing and Maintaining Switches.
13. Simplified Field Work.
14. Special Practice.

FOR 10 DAYS' FREE EXAMINATION

Just Clip and Mail This Coupon



SIMMONS-BOARDMAN
FREE EXAMINATION COUPON

Simmons-Boardman Publishing Company,
Book Department,
30 Church Street, New York, N. Y.; 34 Victoria St., London, S. W. 1.

Please send me post paid for ten days' free examination a copy of Simplified Curve and Switch Work. I will either return the book or remit $2.00.

NAME .....

ADDRESS .....

CITY ..... STATE .....

POSITION ..... COMPANY .....

MT-11-27

Buyers' Guide

CLASSIFIED INDEX TO ADVERTISERS

Acetylene Dissolved
Oxweld Railroad Service Company

Air Compressors
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Generator Set
Buda Company

Air Hoists
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Lift Pumping Machinery
Ingersoll-Rand Co.
Sullivan Machinery Co.

Anchors, Rail
See Rail Anchors

Anti-Creepers, Rail
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Lundie Engineering Co.
P. & M. Co.
Track Specialties Co.
Verona Tool Works
Woodings Forge & Tool Co.

Asbestos Products
Johns-Manville Corp.

Asphalt
Barber Asphalt Co.
Lehon Co.

Automatic Take-Up Reels
Hayward Co.

Ballast Cleaners
Industrial Brownhoist Corp.

Ballast Screens
Maintenance Equipment Co.

Ballast Spreaders
Jordan Co., O. F.
Western Wheeled Scraper Co.

Bank Builders
Jordan Co., O. F.

Bank Slopers
Jordan Co., O. F.

Ballast Trimmers
Jordan Co., O. F.

Band Saws
American Saw Mill Machy. Co.

Bars
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Bearings, Axle
Buda Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Company
Northwestern Motor Co.
Woolery Machine Co.

Bearings, Roller
Fairbanks, Morse & Co.
Hyatt Roller Bearing Co.
Timken Roller Bearing Co.

Benders, Rail
See Rail Benders

Blocks, Paving
Interstate Car & Foundry Co.

Blowers, Turbo
Ingersoll-Rand Co.

Bolts
Bethlehem Steel Co.
Graham Bolt & Nut Co.
Illinois Steel Co.
Inland Steel Co.
Track Specialties Co.

Bonding Outfits, Rail
Ingersoll-Rand Co.

Braces, Track
Coover Railroad Track Brace Co.
Edelblute Co., T. H.
Ramapo Ajax Corp.

Buckets
Hayward Co.
Industrial Brownhoist Corp.
Owen Bucket Co.
Williams Co., G. H.

Buckets, Clam Shell
Hayward Co.
Industrial Brownhoist Corp.
Owen Bucket Co.
Williams Co., G. H.

Buckets, Drag Scrape; Orange Peel; Electric Motor
Hayward Co.
Williams Co., G. H.

Buckets, Tote
Railroad Accessories Corp.

Building Beams, Concrete
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

Building Material
Johns-Manville Corp.

Building Papers
Lehon Co.

Bumpers, Car
Track Specialties Co.

Bumping Posts
Buda Company
Mechanical Mfg. Co.

Calcium Carbide
Oxweld Railroad Service Co.

Car and Locomotive Replacers
Edelblute Co., T. H.

Car Replacers
Edelblute Co., T. H.

Cars, Ballast
See Ballast Cars

Cars, Dump
See Dump Cars

Cars, Hand
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Mudge & Co.
Northwestern Motor Co.

Cars, Industrial
Koppel Industrial Car & Equipment Co.
Magor Car Corp.
Western Wheeled Scraper Co.

Cars, Inspection
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Motor
Buda Co.
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Section
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Car, Spreader
Jordan Co., O. F.
Western Wheeled Scraper Co.

Car Stop, Friction
Maintenance Equipment Co.

Cars, Velocipede
Buda Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.

Castings
Bethlehem Steel Co.
Wharton, Jr. & Co., Inc., Wm.

Cattle Guards
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.

Cattle Passes
Massey Concrete Products Corp.

Cement, High Temperature
Johns-Manville Corp.

Cement Repair
Barber Asphalt Co.
Carey Co., Philip

Clamshell Buckets
See Buckets, Clamshell

Clips, Adjustable
Ramapo Ajax Corp.

Coal Handling Machinery
Hayward Co.
Industrial Brownhoist Corp.

Coaling Stations
Fairbanks, Morse & Co.

Compressors
Ingersoll-Rand Co.
Sullivan Machinery Co.

Compromise Joints
See Joints, Compromise

Concrete Units, Miscellaneous
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

Condensers
Ingersoll-Rand Co.

Corrugated Iron
Armco Culvert & Flume Mfrs. Ass'n.

Counterweight Drums
Hayward Co.

Cranes, Barge, Electric Erecting, Gantry, Locomotive, Pillar, Transfer, Tunnel, Wharf and Wrecking
Industrial Brownhoist Corp.
Interstate Car & Foundry Co.

Creosoted Timber
See Timber, Creosoted

Cribbing, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.

Crossing Gates
Buda Co.
Kalamazoo Railway Supply Co.

Crossings, Highway
Barber Asphalt Co.
Carey Co., Philip
Headley Good Roads Co.

Crossings, Rail
Bethlehem Steel Co.
Buda Co.
Interstate Car & Foundry Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Crushers, Stone
Western Wheeled Scraper Co.

Culvert Pipe
American Cast Iron Pipe Co.
American Casting Co.
Armco Culvert & Flume Mfrs. Ass'n.
Central Alloy Steel Corp.
Massey Concrete Products Corp.

Curbing
Massey Concrete Products Corp.

Derails
Q. & C Co.
Track Specialties Co.
Wharton Jr. & Co., Wm.

Derailing Switches
Ramapo Ajax Corp.

Derrick Cars
Maintenance Equipment Co.

Diesel Engines
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Diesel Electric Power Plants
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Discing Machines
Fairmont Railway Motors, Inc.

Disinfectants
Chipman Chemical Engineering Co.

Ditchers
Jordan Co., O. F.

Doors
Richards-Wilcox Mfg. Co.

Drains, Perforated
Central Alloy Steel Corp.

Drills, Earth
Buda Co.

Drills, Pneumatic
Ingersoll-Rand Co.

Drills, Rock
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

Drill Steel, Rock
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Buda Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Railroad Accessories Corp.

Drinking Fountains
Murdock Mfg. & Supply Co.
Taylor Co., Halsey W.

Dump Cars
Differential Steel Car Co.
Jordan Co., O. F.
Koppel Industrial Car & Equipment Co.
Magor Car Corp.
Western Wheeled Scraper

Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
See Cranes

Electric Light & Power Plants
Fairbanks, Morse & Co.

Electric Power Units
Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

Electric Snow Melters
Greenfield Co.
Q & C Co.

Engines, Gasoline
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Oil
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc..
Ingersoll-Rand Co.

Fences
American Steel & Wire Co.
Cyclone Fence Co.
Page Fence Association
Q & C Co.

Fence, Fabric
American Steel & Wire Co.
Cyclone Fence Co.
Page Fence Association

Fence Posts
Maintenance Equipment Co.
Massey Concrete Products Corp
Page Fence Association
Q & C Co.
Sweet's Steel Co.

Fibre Angle Pieces, Bushings, Plates, End Plates, etc.
Q & C Co.

Fibre Insulation
Q & C Co.

Filters
American Water Softener Co.

Fire Fighting and Protection Equipment
Johns-Manville Corp.

Flangers, Snow
Q & C Co.

Float Valves
Fairbanks, Morse & Co.

Floor Coverings
Barber Asphalt Co.
Lehon Co.

Flooring Compositions
Johns-Manville Corp.

Foot Guards
Track Specialties Co.

Forgings
Bethlehem Steel Co.
Interstate Car & Foundry Co.

Frogs
Bethlehem Steel Co.
Buda Co.
Interstate Car & Foundry Co.
Ramapo Ajax Corp.
Track Specialties Co.
Wharton Jr. & Co., Inc., Wm.

Gages, Measuring
Lufkin Rule Co.

Gages, Pressure Gas
Oxweld Railroad Service Co.

Gas, Acetylene
Oxweld Railroad Service Co.

Gauge Rods
Edelblute Co., T. H.
Track Specialties Co.

Graders, Elevating
Western Wheeled Scraper Co.

Grading Machinery
Western Wheeled Scraper Co.

Graphite
Dixon Crucible Co., Jos.

Grinders, Portable
Buda Co.
Ingersoll-Rand Co.

Guard Rails
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co.
Q & C Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

Guard Rail Braces
Track Specialties Co.

Guard Rail Clamps
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Track Specialties Co.
Wharton Jr. & Co., Wm.
Q & C Co.

Hammers, Chipping, Scaling and Caulking
Ingersoll-Rand Co.

Hammer Drills
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hammers, Forge
Sullivan Machinery Co.

Hammers, Riveting
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hand Car Bearings
Hyatt Roller Bearing Co.
Timken Roller Bearing Co.

Head Drains, Perforated
Central Alloy Steel Corp.

Heaters, Feed Water
American Water Softener Co.

Highway Crossings
See Crossings, Highway

Hoisting Machinery
Fairbanks, Morse & Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Hoists, Air Motor
Ingersoll-Rand Co.

Hose
Ingersoll-Rand Co.

House Lining
Barber Asphalt Co.
Lehon Co.

Hydrants, Fire
Murdock Mfg. & Supply Co.
Taylor Co., Halsey W.

Hydrants, Self-Closing
Murdock Mfg. & Supply Co.
Taylor Co., Halsey W.

Ice Cutters
Jordan Co., O. F.

Inspection Cars
See Cars, Inspection

Inspection, Engineering
Hunt Co., Robert W.

Insulated Rail Joints
Bethlehem Steel Co.
Q & C Co.
Rail Joint Co.
Track Specialties Co.

Insulating Material
Barber Asphalt Co.
Johns-Manville Corp.
Lehon Co.

Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.

Jacks, Smoke
Johns-Manville Corp.

Jacks, Track
Buda Company
Hackmann Railway Supply Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
Bethlehem Steel Co.
Metal & Thermit Corp.
Q & C Co.
Rail Joint Co.
Track Specialties Co.

Joint Fastenings
Illinois Steel Co.

Joints, Rail
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Inland Steel Co.
Metal & Thermit Corp.
Q & C Co.
Rail Joint Co.
Track Specialties Co.
Wharton Jr. & Co., Wm.

Joints, Step
Illinois Steel Company
Inland Steel Co.
Q & C Co.
Rail Joint Co.
Track Specialties Co.

Joints, Welded
Metal & Thermit Corp

Junction Boxes
Massey Concrete Products Corp.

Knuckles, Emergency
Q & C Co.

Liners, Track
Chicago Steel Foundry Co.
Hackmann Railway Supply Co.
Rail Joint Co.
Track Specialties Co.

Lock Washers
National Lock Washer Co.
Reliance Manufacturing Co.
Track Specialties Co.

BUYERS' GUIDE

Locomotives, Oil Engine Electric Driven
Ingersoll-Rand Co.

Lubricants
Dixon Crucible Co., Jos.

Lumber, Asbestos
Johns-Manville Corp.

Manganese Track Work
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Mile Posts
Massey Concrete Products Corp.

Mono Cars
Track Specialties Co.

Motor Bearings
Hyatt Roller Bearing Co.
Timken Roller Bearing Co.

Motor Car Accessories
Mudge & Company

Motor Cars
See Cars, Motor

Motors & Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.
Mudge & Co.

Nails, Tie Dating & Marking
Track Specialties Co.

Non-Derailer
Ramapo Ajax Corp.

Nut Locks
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Graham Bolt & Nut Co.
Illinois Steel Co.
Interstate Car & Foundry Co.

Oil Burners
Littleford Bros.

Oil Engines
See Engines, Oil

Out Houses
Massey Concrete Products Corp.

Oxygen
Oxweld Railroad Service Co.

Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Packing, Asbestos
Johns-Manville Corp.

Paint
Chipman Chemical Engineering Co.
Dixon Crucible Co., Jos.

Paint, Metal Protecting
Barber Asphalt Co.
Dixon Crucible Co., Jos.

Pavement Breakers
Ingersoll-Rand Co.
Sullivan Machinery Co.

Penstocks
Fairbanks, Morse & Co.

Pile Drivers
Ingersoll-Rand Co.
Industrial Brownhoist Corp.

Piling
Carnegie Steel Co.
International Creosoting & Construction Co.
Massey Concrete Products Corp.
Prettyman & Sons, J. F.

Pipe, Cast Iron
American Cast Iron Pipe Co.
American Casting Co.
Cast Iron Pipe Research Assn.
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert & Flume Mfrs. Ass'n

Pipe, Sewer
American Casting Co.
Central Foundry Co.
Massey Concrete Products Corp.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Plates, Miscellaneous
Ramapo Ajax Corp.
Track Specialties Co.

Platforms, Station
Headley Good Roads Co.

Plows, Railroad
Western Wheeled Scraper Co.

Poles
International Creosoting & Construction Co.
Massey Concrete Products Corp.

Post Hole Digger
Buda Company
Prettyman & Sons, J. F.

Posts, Fence
See Fence Posts

Posts, Bumping
See Bumping Posts

Power Plants, Portable
Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

Preformed Track Pavement
Carey Co., Philip

Preservation, Timber
International Creosoting & Construction Co.
Prettyman & Sons, J. F.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Slump
American Well Works
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Layne & Bowler
Sullivan Machinery Co.
United Iron Works, Inc.

Push Cars
Buda Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.

Push Car Bearings
Hyatt Roller Bearing Co.
Timken Roller Bearing Co.

Rail Anchors
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Lundie Engineering Corp.
P. & M. Co.
Track Specialties Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Anti-Creepers
See Anti-Creepers, Rail

Rail Benders
Buda Co.
Q & C Co.
Track Specialties Co.
Verona Tool Works

Rail Bonds
Verona Tool Works
Q & C Co.

Rail Braces
Bethlehem Steel Co.
Buda Co.
Coover Railroad Track Brace Co.
Q & C Co.
Ramapo Ajax Corp.
Track Specialties Co.
Wharton Jr., & Co., Wm.

Rail Chair
Track Specialties Co.

Rail Clip
Track Specialties Co.

Rail Expanders
Ramapo Ajax Corp.

Rail Joints
See Joints, Rail

Rail Layers
Maintenance Equipment Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q & C Co.
Track Specialties Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Inland Steel Co.
Carnegie Steel Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Removers, Paint and Varnish
Mudge & Co.

Replacers, Car
Buda Co.
Edelblute Co., T. H.
Q & C Co.
Track Specialties Co.

Replacers, Car & Locomotive
Edelblute Co., T. H.

Replacing Frogs
Edelblute Co., T. H.

Rerailers
Edelblute Co., T. H.

Retaining Walls, Precast
Federal Cement Tile Co.
Massey Concrete Product Corp.

Rivets
Bethlehem Steel Co.

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Asbestos
Johns-Manville Corp.

Roofing Composition
Barber Asphalt Co.
Lehon Co.

Roofing, Corrugated
Johns-Manville Corp.

Rules
Lufkin Rule Co.

Saw Mills
American Saw Mill Machy. Co.

Saw Rigs
American Saw Mill Machy. Co.
Fairbanks, Morse & Co.

Saws, High Speed Friction
American Saw Mill Machy. Co.

Scales, Track
Fairbanks, Morse & Co.

Scales, Tape
Lufkin Rule Co.

Scoops
Ames Shovel & Tool Co.

Scrapers, Wheel, Drag & Buck
Western Wheeled Scraper Co.

Screw Spikes
Illinois Steel Company
Track Specialties Co.

Screw Spike Drivers
Ingersoll-Rand Co.

Screw Spike Wrench
Track Specialties Co.

Section Cars
See Cars, Section

Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Sheathing Paper
Barber Asphalt Co.
Lehon Co.

Sheet Iron
Armco Culvert & Flume Mfrs. Ass'n.

Sheets, Corrugated
Johns-Manville Corp.

Sheet Steel
Inland Steel Co.

Shims
Track Specialties Co.

Shingles, Composition
Barber Asphalt Co.
Lehon Co.

Shovels
Ames Shovel & Tool Co.
Interstate Car & Foundry Co.
Verona Tool Works
Woodings Forge & Tool Co.

Siding, Corrugated and Plain
Johns-Manville Corp.

Signal Foundations, Concrete
Massey Concrete Products Corp.

Signals, Bridge Warnings
Hastings Signal & Equip. Co.

Skid Excavators & Dredges
Hayward Co.

Skid Shoes
Q & C Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smoke Stacks
Massey Concrete Products Corp.

Snow Fence
Track Specialties Co.

Snow Melting Device
Greenfield Co.
Littleford Bros.
Q & C Co.

Snow Plows
Jordan Co., O. F.
Q & C Co.

Spades
Ames Shovel & Tool Co.

Spike Pullers
Louisville Frog & Switch Co., Inc.

Spikes
Bethlehem Steel Co.
Illinois Steel Company
Inland Steel Co.
Track Specialties Co.

Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

Standpipes
Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
O & C Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Step Joints
See Joints, Step.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Inland Steel Co.
Illinois Steel Company

Switch Guard
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co.
Buda Company
Interstate Car & Foundry Co.
Ramapo Ajax Corp.
Track Specialties Co.
Wharton Jr. & Co., Wm.

Switch Brace
Track Specialties Co.

Switchmen's Houses
Massey Concrete Products Corp.

Switchpoint Protector
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Track Specialties Co.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tank Fixtures
Fairbanks, Morse & Co.

Tape, Insulating
Johns-Manville Corp.

Tapes, Measuring
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telephone Service, Long Distance
American Telephone & Telegraph Co.

Telegraph Poles
See Poles

Telegraph Service, Long Distance
American Telephone & Telegraph Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Greenfield Co.
Littleford Bros.
Q & C Co.

Thermit Welding
Metal & Thermit Corp.

Ties
International Creosoting & Construction Co.
Prettyman & Sons, J. F.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Inland Steel Co.
Lundie Engineering Corp.
Railroad Supply Co.
Sellers Manufacturing Co.
Track Specialties Co.

Tie Plate Clamps
Q & C Co.

Tie Rods
Bethlehem Steel Co.
Track Specialties Co.

Tie Spacers
Maintenance Equipment Co.

Ties, Steel
Track Specialties Co.

Tie Tampers
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

Ties, Tongs
Track Specialties Co.

Timber, Bridge
Interstate Car & Foundry Co.

Timber, Creosoted
International Creosoting & Construction Co.
Prettyman & Sons, J. F.

Timber, Slab
Interstate Car & Foundry Co.

Tile, Roofing
Federal Cement Tile Co.

Track Insulation
Q & C Co.

Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Buda Co.
Hackman Railway Supply Co.
Maintenance Equip. Co.
Q & C Co.
Track Specialties Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Barrow
Track Specialties Co.

Track Braces
See Braces, Track

Track Drills
See Drills, Track

Track Gages
Buda Co.
Kalamazoo Railway Supply Co.
Track Specialties Co.

Track Jacks
See Jacks, Track

Track Levels
Kalamazoo Railway Supply Co.
Track Specialties Co.

Track Liners
See Liners, Track

Track, Portable
Western Wheeled Scraper Co.

Track Tools
See Tools, Track

Treating Plants, Water
American Water Softener Co.

Trestle Slabs
Massey Concrete Products Corp.

Ventilators
Johns-Manville Corp.
Q & C Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Water Softening Plants
American Water Softening Co.

Water Treating Plants
American Water Softening Co.

Waterproofing Fabrics
Barber Asphalt Co.
Johns-Manville Corp.
Lehon Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q & C Co.

Well Systems
Layne & Bowler

Well Supply Contractors
Layne & Bowler

Welding & Cutting Equipment
Oxweld Railroad Service Co.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Welding, Thermit
Metal & Thermit Corp.

Wheels, Hand & Motor Car
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

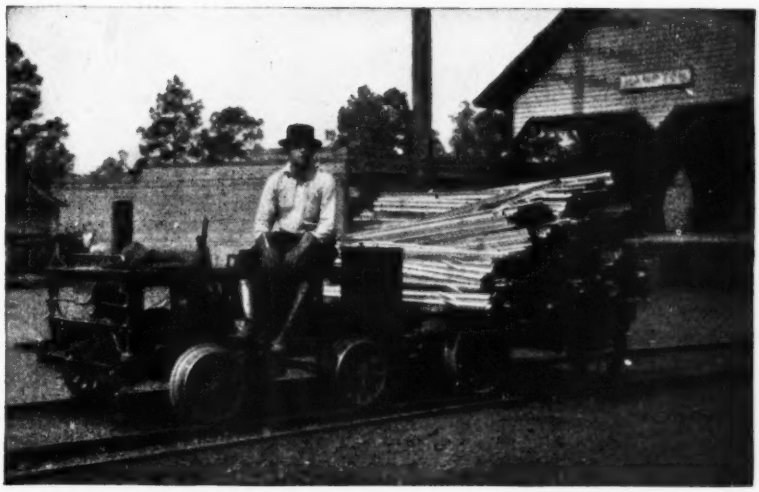
Windshields
Fairbanks, Morse & Co.
Mudge & Co.

Wire Fencing
American Steel & Wire Co.
Cyclone Fence Co.
Page Fence Association

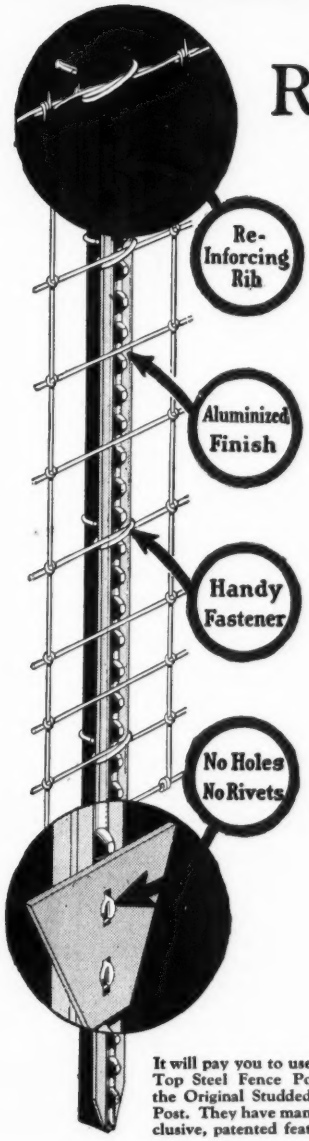
Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machy. Co.

ALPHABETICAL INDEX TO ADVERTISERS



This photograph shows how one prominent railroad delivers Red Top Steel Fence Posts to the job. The trailer carries 800 posts, enough for about 2½ miles of fence. This one man takes the posts out of the storehouse and loads them. When he reaches the job the posts are thrown off one at a time. Quite a difference between this method of delivery and the expensive method of handling old-fashioned wood posts.



It will pay you to use Red Top Steel Fence Posts—the Original Studded Tee Post. They have many exclusive, patented features.

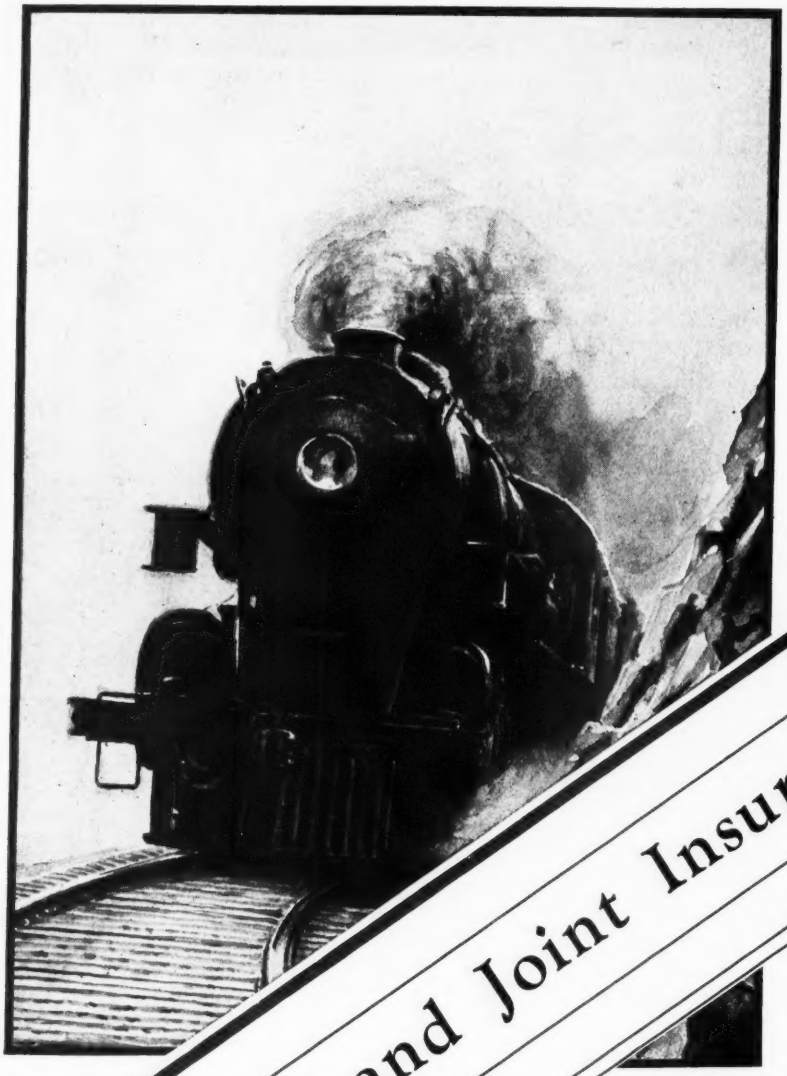
RED TOP Steel Fence Posts Reduce Handling Costs

RIGHT from the start RED TOP Steel Fence Posts make savings. See how easy they are handled and delivered to the job.

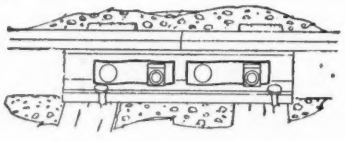
Delivering RED TOP Steel Posts is a one-man job. And it is quick. No cumbersome, slow worktrain and crew of men are necessary as when bulky wood posts are used.

More than fifty large railroads save fencing money by using RED TOPS. We'll be pleased to talk the matter over with you. Write us.

INLAND STEEL COMPANY
38 S. Dearborn St., Chicago



Rail and Joint Insurance



Rails are expensive. So are joints. But Verona Rail Joint Springs are not.

The money invested in Verona Rail Joint Springs is saved very quickly by the protection which the springs give to the rails and the joints.

The springs make positive just the right degree of tightness of the bolts. They couple the bolts in pairs and thereby equalize the strain. They cushion the shock of the rolling load and thereby decrease the battered rail ends and rapid joint wear that are inevitable when bolts are too rigidly tight. Thus the least expensive part of your track equipment is the best insurance of the most expensive parts. It is sound economy to invest in Verona Rail Joint Springs.

VERONA TOOL WORKS - - - PITTSBURGH